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Introduction to Symposium on the Treatment and Care of Advanced Cancer Patients[1]

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When radiology began to play its part in the treatment of the various malignant growths, it was natural that, in advanced cases in which there was no longer hope of cure, a custom which had been followed by the surgical consultant over the years should have been adopted According to this custom, when active treatment was completed, the patient was referred back to the family physician for supervision and direction In the main, this practice prevails today Shortage of hospital accommodation everywhere makes it impossible to care for all advanced cases in institutions, and in many cases the downward course is so prolonged that hospitalization would represent a hardship rather than a benefit for the patient The referring back of such cases to the family physician may mean the best possible care, but such a fortunate outcome is by no means certain The family physician may be poorly trained in such problems, in which event he will have little interest in the case and little concern for the outcome The probable result will be that treatment will consist for the most part in administration of the better known types of sedatives

Very few practitioners know the picture of advanced cancer as well or have so close a personal interest in it as the experienced radiologist If we are to take a more active part in the care of these cases in the future, it is clear that a summing up of our present knowledge is well worth while It is, of course, obvious that there must be no slackening of interest in, and study of, pre-malignant conditions, but until new successes crown the tireless efforts of the research workers and place in the hands of the medical profession new and improved methods of treatment, the advanced case will continue to be the largest part of the cancer problem, both numerically and in terms of human suffering

A frank assessment of the possibilities and limitations of our science and our art in the care of these unfortunate patients may surprise many by showing how much can be done and may well assist and direct further research into the whole problem of malignant disease It may be recalled that the original work done by Dr Trudeau at Saranac Lake was almost completely limited to advanced cases He set the pattern of treatment for many years, and his skill and vision made possible many later advances in his special field No one can say that the cancer problem may not yet be solved through the study of the advanced as well as the early case

[1] Presented at the Thirty second Annual Meeting of the Radiological Society of North America Chicago, Ill, Dec 1-6 1946

urgent everywhere Under whose direction shall this new accommodation be placed—under the radiologist or under the internist and surgeon with the radiologist as consultant? That is but one question—there are many It is our problem—it affects us all The therapeutic obligation rests upon each one of us and we cannot shirk our responsibilities

I referred a moment ago to Dr Trudeau His maxim regarding the practice of medicine remains, I think, the best definition we have "To cure sometime, to relieve often, to comfort and support always That is our text for today

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Care of Patients with Advanced Pelvic Cancer[1]

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IT IS NOT WITHIN the scope of this paper to discuss the management of early pelvic cancer but, in order to open the discussion of some of the problems of the advanced lesion, brief mention will be made of the indications for the methods of treatment of the various types of malignant growth in this area

For primary carcinoma of the vagina, treatment in any stage is a radiological problem Surgical procedures in this type of cancer have proved to be unsatisfactory, and all cases are treated by radiation methods

As to cervical cancer, in the average cancer clinic probably only from 10 to 15 per cent of the cases are first seen in Stage I, or the operable stage Consequently, about 85 to 90 per cent must be considered entirely as radiological problems In a few centers certain selected early cases are being submitted to radical surgery, but in most clinics all cervical cancer is referred for irradiation regardless of the stage of the disease

Carcinoma of the fundus is a surgical problem except in cases with extension outside the uterus In the operable cases, however, preoperative radium therapy is indicated, followed by surgery in about six weeks Some surgical procedures have been used, in the past, in advanced cases with pelvic node involvement Attempts were made to insert radon seeds in involved nodes, but this measure is now obsolete Another endeavor was the operative removal of the pelvic lymph nodes This practice was never widely accepted and may be considered as practically abandoned

Radiological treatment of vaginal and cervical cancer has been quite well established during the past quarter of a century, with a gradual improvement in technic and results The improvement in technic has helped to salvage more of the advanced cases There is some evidence, as pointed out by Holmes and his associates, that the use of supervoltages may increase the percentage of immediate regression of the disease, prolonging life in greater comfort and avoiding some of the bad effects of irradiation at lower voltages

Irradiation in pelvic cancer should be considered as a major medical and surgical undertaking, and the patient should be prepared and followed as carefully as with an operative procedure Complications will occur and must be treated as they arise Definite morbidity and a low percentage of mortality may be expected Pre-existing pelvic inflammation is the cause of the majority of complications which occur during radiation treatment Every attempt should be made to eradicate infection before treatment is commenced Douches, sulfa drugs, penicillin, and transfusions, if necessary, should be resorted to In the more advanced cases, in which some infection is always present, it is advisable to use roentgen therapy before inserting radium locally The best treatment of complications which may later arise is their prevention

The technic of radiation therapy will not be discussed here A combination of radium and roentgen therapy is indicated in all except the most advanced or Stage IV cancers In Stage IV, roentgen therapy alone is usually indicated, although some patients may show such marked improvement that additional radium treatment may be given In some cases radium alone may be used to arrest hemorrhage An advanced case should not be abandoned

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[1] From the Los Angeles Tumor Institute Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill , Dec 1–6, 1946

cult to determine without biopsy if there is coexisting cancer If cancer is not present, the condition usually disappears without the formation of fistula

Postoperative cases of advanced pelvic cancer, those which have had large amounts of radiation therapy without arrest of the disease, and those which have reached such a stage when first seen that no treatment is indicated present a special problem of medical palliation These cases cannot be abandoned, and measures for purely symptomatic relief must be used

Pain is usually the most difficult symptom to control, and a wide variety of measures have been resorted to for its relief Cobra venom and various non-opiates have been used with little success The advanced case should not be condemned to narcotics until all other sedative measures have been tried Various combinations of the non-opiates may suffice for a long time Combinations of the milder opiates, such as codeine with acetylsalicylic acid and phenacetin or other drugs may be used Eventually the old reliable morphine may have to be called upon regardless of the wonders of demerol, so recently extolled in the press, and other preparations of the opiates

Surgery in the form of nerve section and alcohol injection have been used for many years in attempts to relieve severe pelvic pain The subarachnoid injection of alcohol has been employed, but in the relief of pelvic pain this method has not been so successful as in other parts of the body The results have varied with the employment of different technics In our experience, the method has been unsuccessful except as a temporary measure Other surgical procedures used have been posterior rhizotomy, anterolateral chordotomy, and presacral nerve section In the hands of experienced neurosurgeons these procedures have afforded pain relief in selected cases The number of patients thus treated, however, is small compared to the large number in whom the disease is allowed to continue its routine course to the end Most of the surgical procedures are considered too formidable for the average case

Many medical procedures are indicated to afford the patient with advanced disease greater comfort, as supportive measures, transfusions, liver, iron, calcium, vitamins, proper dietary regulation, psychotherapy, and the all-important careful nursing care

The question of follow-up of the advanced case of pelvic cancer is an important one In some centers radium may be applied by a surgeon or gynecologist and roentgen therapy given by the radiologist It may happen that the patient never sees either of these physicians again and is sent back to the family physician We believe that under such a routine the patient loses the value of the experienced attention which she deserves The skill of the general practitioner is not underestimated, and it is perfectly proper that he should have complete charge of the patient However, the radiation therapist should also follow the patient in cooperation with the general physician The radiation therapist should never forget that he is a doctor of medicine and that he has an obligation to any patient he may treat It is his duty to follow the patient at regular intervals throughout her life Often, due to his experience in the examination of patients with radiation reactions and effects, he will be able to pick up evidence of a small recurrence or the appearance of some late complication We have often seen patients salvaged after the adequate treatment of an early recurrence The frequently expressed opinion that if the disease is not controlled during the first series of treatment, further treatment is useless, is not true Additional treatment will often prolong life and occasionally will result in the saving of a case that was apparently hopeless

There is an increasing need for physicians thoroughly trained in cancer therapy who will follow the advanced as well as the early case and give the aid and palliation to which the patient is entitled The hopeless attitude of many physicians

venously when the need arises There is no pain so severe that it cannot be controlled by morphine injected into the vein The barbiturates should also be used freely to ensure sleep and to promote mental tranquillity

Finally, there is the problem of maintaining morale, and the question arises as to what information patients should receive in regard to diagnosis and prognosis Probably the patients who do the best are those who know what is wrong with them, who understand what is being done for them, and who are willing to endure without too much complaint whatever discomfort is necessary On the other hand, perhaps the most difficult patients are those who have been deceived as to the diagnosis and have been told that they do not have a serious disease There is some justification for their complaint that "the cure is worse than the disease," and for their secret worry because so many unpleasant things are being done for what they have been led to understand is a minor disorder

There is a great deal of discussion about the proper answer to the questions "Do I have a cancer?" and "What chance do I have to get well?" There can be no doubt that sometimes elderly, infirm patients can be spared needless worry by evasive or even untruthful answers to these questions Doctors know that there are still many people who firmly believe cancer to be hopelessly incurable in spite of all that has been said and written about its curability To these people a diagnosis of cancer is the same as a death sentence There are others whose families insist that they be kept in ignorance But we must remember that when a patient goes to a doctor for a diagnosis he literally lays his life in that doctor's hands Surely, if he is a normal person in full possession of his faculties, he has a right, in common honesty, to expect a truthful answer to his questions If he does not want the answer, he need not ask

On the other hand, it is not always necessary, or even advisable, to tell patients with advanced cancer that they cannot recover Occasionally some patient who is a close friend will insist upon a definite expression of opinion, but giving a hopeless prognosis can usually be almost indefinitely postponed The most common complaint of those with advanced cancer is of weakness and fatigue, but those symptoms, together with the wasting and emaciation that accompany them, are often more distressing to the family than to the patient As a rule, the patient with hopeless cancer of the breast, when she finally realizes that she is not going to recover, is so weak and tired that she does not greatly care

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SUMARIO

Asistencia del Cáncer Avanzado de la Mama

El cáncer mamario avanzado comprende dos formas En una la dolencia está localizada, con ulceración y fijación a la pared torácica, en la otra, hay metástasis muy esparcidas, con o sin ulceración local

Los cánceres del primer tipo representan primordialmente problemas quirúrgicos, aunque la irradiación preoperatoria puede convertir en operable un caso aparentemente inoperable, en tanto que en las enfermas de mayor edad puede retardar a tal punto la propagación de la lesión que les permite llegar al término de su vida normal sin que jamás experimenten los desagradables síntomas del cáncer avanzado

En el cáncer que ha metastatizado más allá de la axila, hay que abandonar toda esperanza de curación permanente y que limitar el tratamiento a retardar la difusión del mal y aliviar el dolor En esos casos recomiéndase la castración Contra el dolor debido a las metástasis óseas, los rayos X a dosis pequeñas pueden resultar útiles El dolor derivado de la compresión de los nervios puede exigir la cirugía El veneno de cobra también ha dado buen resultado En algunos casos se necesitará la morfina

SYMPTOMS

The most common symptoms in advanced cancer of the mouth and pharynx are pain, a sore or lump in the mouth or throat, lumps in the neck, increasing inability to open the mouth, difficulty in swallowing, difficulty in breathing, and loss of weight A foul breath and a bad taste in the mouth are common symptoms, and bleeding is frequent

Pain may have been present for weeks or months It varies according to the extent and location of the primary disease, the amount of infection present, and the degree of metastatic involvement of the cervical lymph nodes In cancer of the lip and anterior two-thirds of the mouth and in most adenocarcinomas, pain usually appears late in the course of the disease It is limited first to the regional area, then extends along the jaw bone, and eventually to the ear, neck, and side of the head It is unilateral in the beginning but finally bilateral as the whole lip, the jaw bone, and neck nodes are involved

In squamous-cell carcinomas of the posterior third of the mouth and pharynx, pain in the ear is usually the first complaint It appears early and is due to ulceration and infection Later the pain increases in severity and becomes constant, extending along the jaw and the side of the head, involving both sides when the cancer has crossed the mid-line Neck and shoulder pain appear as the metastatic nodes become large and fixed

Trismus appears as the ulceration continues It is due either to the infected ulcer in the mouth or throat or to secondary infection and cellulitis in the neck and mandibulotemporal region

Lumps in the mouth or throat are often the first manifestations of the adenocarcinomas and mixed tumors These tumors are usually found in the buccal mucosa, soft palate, or tonsillar regions They are more slowly growing and in many cases become quite large before ulceration and infection take place They may attain such dimensions that they form a mechanical barrier to swallowing and to talking

Dysphagia occurs commonly in association with ulcerated lesions of the mouth and throat and is frequently so severe that loss of weight and strength is extreme If the cancer involves the hypopharynx or extrinsic larynx, actual involvement of the opening of the esophagus may result

Dyspnea and *stridor* may become evident when the arytenoids and aryepiglottic folds become edematous either from the disease, from secondary infection, or radionecrosis

Bad taste and *foul breath* are associated with ulcerated and necrotic lesions

Bleeding occurs as the ulcer deepens and the infection increases and may terminate in anemia from long continued oozing or massive hemorrhage

Lumps in the neck are often the earliest symptom to be noticed, especially in cancers of the posterior third of the mouth, tonsil, and pharynx These are painless at first but, as they enlarge and become fixed, pain in the neck and shoulder appears, stiffness and tightness of the neck occur, and ulceration often results This ulceration may be continuous between the mouth and neck until half the side of the face is a large oozing, drooling, bleeding, granular, necrotic, foul smelling, ulcerated mass The terminal course in such cases is protracted, painful, and pathetic

DIAGNOSIS

The diagnosis of advanced cancer of the oral cavity is apparent The most common picture is a large, necrotic, infected, infiltrating ulcer combined with hard fixed nodes in the neck A biopsy from the margin of the growth is easily obtained with little discomfort to the patient, and an aspiration biopsy of the palpable nodes may be done without fear of crossing the normal neck barriers or of complicating the case should a radical neck dissection be decided upon It is almost a painless procedure and will in the majority of instances distinguish between a cancerous and noncancerous growth An open biopsy should be avoided, as the normal neck barriers and non-cancerous areas may be crossed, and

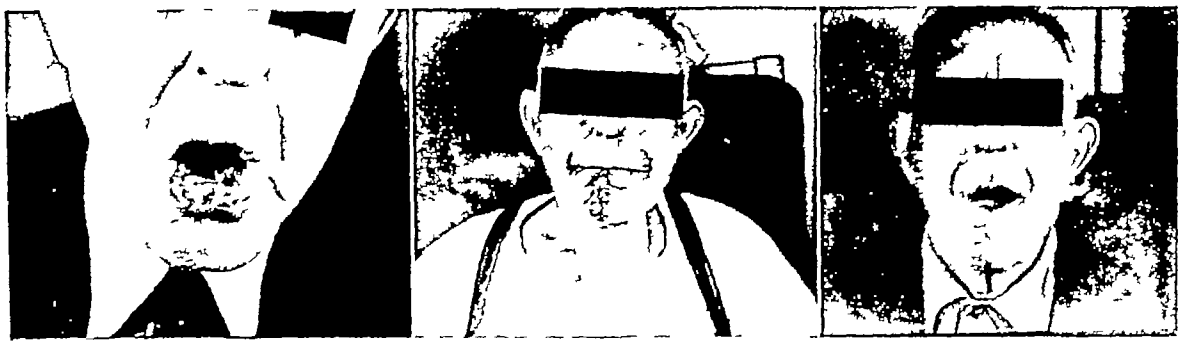

Fig 1 M B , a man aged 76, admitted May 14, 1945, gave a history of a growth on the lip treated two years previously by a paste and six months previously by x rays Examination showed a large infiltrating mass involving almost the entire lower lip, leaving the corners of the mouth free but extending down to the gingival buccal gutter Histologic examination showed squamous-cell carcinoma

Operation consisted in removal of the entire lower lip, including the skin over the chin, freeing of flaps laterally from the transverse ramus of the jaw, and widening of the mouth by the use of mucosal flaps from the buccal mucosa, sacrificing the skin and subcutaneous tissue The patient has remained well to the present time

cancer cells implanted, while a neck dissection is made technically more difficult should it be decided upon

TREATMENT

Intelligent care to alleviate suffering calls for open-mindedness and unselfishness on the part of the physician who sees these unfortunate patients Careful consideration and sound judgment are essential in determining the type, location and extent of the cancer and of the secondary infection, and in reaching a decision, if possible when the patient is first seen, as to the curability or incurability of the disease and the treatment to be employed, whether it be surgery, radiation therapy, or a combination of these agents

As suggested by Dr Murphy, I should like to discuss the treatment under three headings (1) Indications for and Limitations of Surgery, (2) Indications for and Limitations of Radiation Therapy, (3) General Care

INDICATIONS FOR AND LIMITATIONS OF SURGERY

The majority of advanced cancers of the mouth are incurable but many that were considered hopeless as recently as five years ago have now become curable There is always a group of patients in whom surgical procedures may be contraindicated Advanced age and poor physical condition make operation hazardous Highly malignant cancers of the posterior third of the mouth and pharynx do not readily lend themselves to operative removal, regardless of the stage of the disease Fortunately, most of these tumors are radiosensitive and fair results may be obtained with carefully fractionated radiation therapy in cancericidal doses Neck metastases in these cases are likely to be early, widespread, or even bilateral should the mid-line be crossed, and these, too, respond more favorably to judicious radiation therapy than to attempted surgical removal

Most large and bulky cancers of the lip, on the other hand, with or without neck metastases, are extremely difficult to control by radiation therapy In such cases good results have followed wide excision of the primary lesion with plastic repair, combined with a radical neck dissection when the cervical nodes are involved Martin and his associates at Memorial Hospital (New York), as well as others, have shown radical lip, jaw, tongue, floor of the mouth, or buccal mucosa resection, combined with radical neck dissection, to be a feasible, workable, and curative procedure in many cancers which previously were regarded as inevitably fatal The majority of these tumors grow more slowly, metastases are often limited to the upper half of the neck, and they do not lend themselves well to radiation therapy Fixation to the mandible, other factors being considered, is no longer a sign of incurability

Fig 2 J G, a man of 54, was seen July 30, 1945, with a "sore" involving the left side of the mouth and lip which had been present for about twelve years Examination showed an infiltrating tumor of the buccal mucosa and lower lip, measuring 4 × 5 cm It was attached to the jaw bone and roentgenograms showed an area of bone destruction in the immediate vicinity There was no apparent lymph node involvement Histologic examination showed a mixed tumor of the aberrant salivary gland type

An extensive excision was done, including part of the upper lip and side of the face and the lower lip The involved section of the mandible was chiseled away The face was reconstructed as shown in the photograph

The adenocarcinomas and mixed tumors are not amenable to radiation therapy Surgical removal is the procedure of choice both for the primary growth and for the neck nodes should metastases be present

The surgical technic has been described elsewhere and is not within the scope of this paper

LIMITATIONS OF AND INDICATIONS FOR RADIATION THERAPY

Cancers arising in the anterior two-thirds of the mouth which are too far advanced for surgical removal become a problem for palliative x-ray therapy and general medical care General measures will be discussed later Palliative irradiation should be used as an aid to general care—chiefly to facilitate in cleansing and freeing of sloughs and to retard the actual cancerous growth Vigorous treatments at too frequent intervals do not give the highest relief of symptoms

In those highly malignant cancers of the posterior third of the mouth and pharynx, on the other hand, where an attempt at a cure is justifiable, intensive fractionated x-ray therapy through the jaw and intraoral cones, if these will cover the growth, should be used Daily doses of 200 to 300 r (in air) through one or two portals for a total of 4,000 to 6,000 r per portal, depending upon the size of the cone, in about three or four weeks' time, may be used Smaller doses at longer intervals, with a smaller total dosage delivered over a period of months, will seldom result in a cure and should be avoided except as a pa l

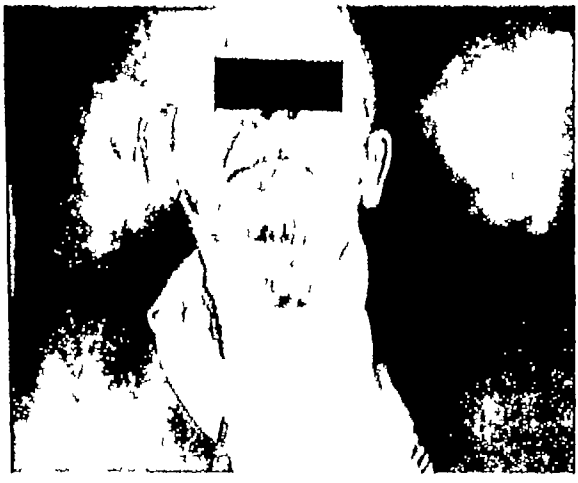

Fig. 3. C. M., a man aged 66, was seen with extensive bilateral neck metastases from a squamous cell carcinoma of the lower lip, which had healed following previous treatment. Palliative measures included roentgen therapy in divided doses to the neck and other pain relieving agents.

procedure. Such treatment is all too common either because of the radiologist's lack of knowledge of the cancer process, including its susceptibility to radiation and its recoverability, or fear of injury or a defeated attitude from the start.

With the highly malignant cancers, widespread metastasis throughout the neck nodes occurs readily. Penetration of the capsule of the node with involvement of the surrounding tissue and fixation is all too frequent a finding. These metastases, however, are more sensitive to radiation than the slower growing metastases from the anterior two thirds of the mouth. X-ray therapy is the treatment of choice, and the portal should be large enough to cover a reasonable area beyond the nodes but not to permit indiscriminate scattering over the neck. Large portals extending far beyond the margins of the tumor greatly diminish the amount of treatment which can be given to the diseased tissues and result in fewer cures and more discomfort, and may actually shorten the life of the patient. The argument used for them, viz. their prophylactic value should the nodes be involved, seems groundless, as the amount of radiation given is far less than a cancericidal dose, usually one to three erythemas, and therefore of little value in controlling cancer whether or not it is palpable. Martin, Quimby, and Pack have shown that seven to ten erythemas are necessary to control most epidermoid carcinomas.

COMBINATION OF RADIATION THERAPY AND SURGERY

X ray therapy in moderate doses is frequently of value in cleaning up infection and may make surgical intervention safer in many primary lesions. It may also be of value in moderate doses in certain cases of neck metastases preliminary to a neck dissection. In patients of advanced years or in poor physical condition, gold seeds of radon implanted in the neck nodes may be the procedure of choice combined with surgical removal or irradiation of the primary cancer.

In still other cases where it has been discovered in the course of a radical neck dissection that the cancer has broken through relatively small areas of neck nodes and has infiltrated beyond the capsules, the implantation of gold seeds in these areas may be of distinct value.

Cancers recurrent after surgical intervention become a palliative problem in which the use of small doses of x rays may be of distinct value. Recurrences after radiation therapy are a serious problem and call for the utmost skill and care to ease the distressing symptoms.

GENERAL CARE

If extensive surgical excision is decided upon, the responsibility for cleansing, general care, and relief of pain should rest with the surgeon. The advanced lesions for the most part are ulcerated, infected, and painful and there is often an associated anemia. Intramuscular penicillin for a few days preoperatively is beneficial in helping to control secondary streptococcal infections. Penicillin is also useful in the management of postoperative infection which may arise from excision of mouth lesions either with or without neck dissection.

The preoperative and postoperative use of penicillin intramuscularly, the sprinkling of sulfa drugs in surgical wounds of the

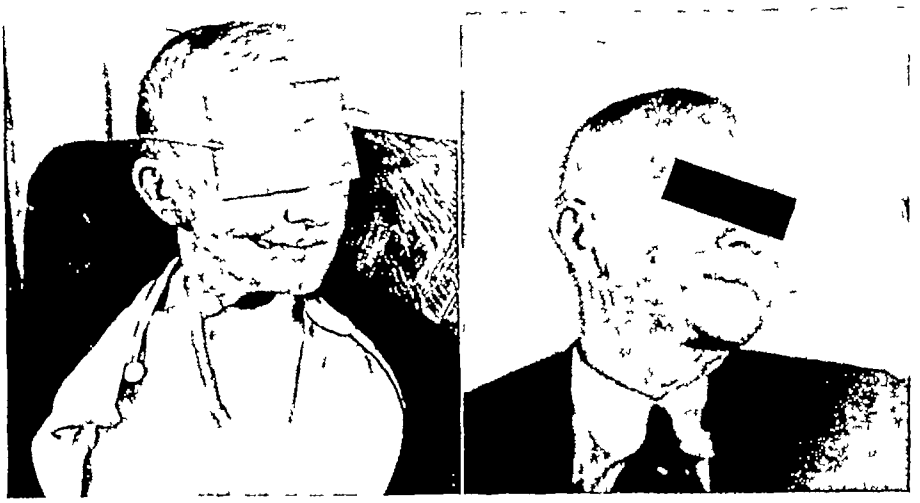

Fig 4 C K , a man aged 70, was first seen on Jan 22, 1941 He gave a history of a sore in the mouth for two years, with local treatment and applications for a year Examination showed an infiltrating, ulcerating tumor involving the buccal mucosa on the right side, extending from the corner of the mouth almost to the anterior tonsillar pillar and from the upper gingival buccal gutter to the lower gingival buccal gutter There were palpable submaxillary nodes Histologic study showed a squamous-cell carcinoma of the buccal mucosa An aspiration biopsy of the nodes in the neck was also positive for carcinoma

Treatment was by roentgen irradiation in divided doses, reinforced by radon seeds to the primary lesion and followed by wide excision and reconstruction of the side of the face with a lined tube graft and an Eastlander's flap from the upper lip to reform the lower lip The metastatic nodes were treated with exposure and gold radon seeds The patient has remained free of disease

neck, nasal catheter feedings, and generous use of whole blood transfusions before, during, and after operation, combined with the elimination, so far as possible, of the primary infection, have greatly lessened the dangers of surgery and in many instances made possible radical procedures

Gentle removal of dead tissue in which saprophytic organisms abound is necessary Vigorous removal to the point of bleeding is not advisable and may open up new channels for spreading infection and may cause further blood loss Frequent preoperative packing with a paste of zinc peroxide and hydrogen peroxide, called Z P O , is beneficial for cleansing ulcers and is a valuable routine postoperative procedure in mouth lesions, the packs being changed every two hours, night and day Penicillin packings have proved of little value, either in the cleansing of the infected ulcer preoperatively or as a wet dressing postoperatively, as the majority of the organisms are saprophytic and are not affected by the drug Even staphylococci seem to thrive in penicillin

Fractionated daily doses of x-ray therapy through one or two portals—150 to 200 r (in air) through each portal—are often highly beneficial preoperatively in lessening infection, cleansing ulcerations, and in determining whether fixation is due partially or wholly to cancerous infiltration, secondary infection, or both Such treatment should not be carried so far that it will delay wound healing

To reiterate, in those cases which are selected for surgery, the preoperative, operative, and postoperative care should be the duty of the surgeon, neither the radiologist, the otolaryngologist, nor the general practitioner should be called upon for cleansing procedures and general care If the surgeon assumes the operative care, he should be equipped to render these services

On the other hand, the radiologist's concern in advanced intra-oral cancer is with patients of advanced age and in poor physical condition, hopeless cases, highly malignant lesions of the posterior third of the mouth, the tonsils, base of the tongue, and pharyngeal wall, bilateral neck

Fig 5 L S, a man of 60 years, had a sore on the tongue of three months' duration The tongue was enlarged and salivation was profuse. The patient had received antisyphilitic therapy for a year A heaped-up, crusting leukoplakia covered the entire tongue, several ulcers were scattered at random over its upper surface, and it was involved, together with the floor of the mouth, in an infiltrating, hard, fixed tumor, with bilateral neck nodes Histologic examination showed squamous-cell carcinoma

Palliative procedures included frequent cleansing of the slough and ulcers in the office, irrigations at home, and Z P O packings both at home and in the office

node involvement, and highly malignant and widespread unilateral disease of the nodes with fixation, except as previously noted If he is to undertake the care of these patients, seeing them almost daily, he should be prepared to make the repeated examinations essential for the highest cure rate and the greatest palliative effect Daily removal of slough, frequent packing of ulcers with Z P O, repeated mouth irrigations (not gargles), and other relief measures should all be assumed by him Cancers of the mouth comprise but a small part of the practice of the referring otolaryngologist, surgeon, or general practitioner, and these physicians seldom have the facilities, or indeed the willingness, to carry out daily or frequent treatments Even if they did, the patient would have the added burden of commuting constantly between various offices, spending time and physical energy often beyond his limited strength

Many referring physicians feel that the radiologist should be able, by some magic, to give the x-ray treatment with such effect that nothing further is required and have actually been known to resent the latter's use of a head or laryngeal mirror So, too, there are radiologists who have been content or even happy not to assume any added responsibility, feeling in many instances that their duty ends with the giving of x-ray or radium therapy and frequently being unequipped to render further measures of relief Some appear to feel that giving an x-ray treatment is analogous with making an x-ray diagnosis—that this is their sole duty While the physical agent is the same, the taking and interpretation of an x-ray film and the intelligent and adequate treatment of the cancer patient are not otherwise to be compared

Among general therapeutic measures, warm sodium bicarbonate or saline mouth douches at brief intervals—hourly in many cases—are highly beneficial for the relief of infection and pain A two-quart douche can with rubber hose and a blunt glass tip may be used by the patient in his own bathroom

Proper dietary measures are important In many cases a high-calorie liquid diet may be required, as eating and swallowing may be a difficult and painful procedure Two quarts of milk, a half dozen eggs, fruit juices, fresh vegetable purées, with adequate vitamin supplements, may be necessary and invaluable at times Citrus juices often cause severe pain A tablespoonful of powdered (brewers') yeast, three times daily, is an excellent means of supplying vitamin-B complex and greatly aids in lessening radiation sickness

Cancers involving the tongue, tonsils, or hypopharynx interfere especially with deglutition, and those of the soft palate involving the muscularis prevent the closing off of the nasopharynx during the act of swallowing, permitting liquids to run out through the nose To maintain proper nutrition in such cases, feedings through a nasal catheter are invaluable In other cases, where swallowing may be difficult over longer periods of time, it may be necessary to perform a permanent gas-

trostomy In the presence of edema of the extrinsic larynx from the disease or from radionecrosis, with dyspnea, a tracheotomy tube should be inserted without delay This precaution can usually be taken before treatment has been begun, for it is not wise to interrupt the treatments for this procedure when the possibility of its need is recognized beforehand

Cleansing douches and pressure sprays to relieve the thick tenacious mucus and discharges greatly lessen the danger of aspiration of infected material into the bronchi and a resulting pneumonia

Infected loose teeth should be removed Even normal teeth, if they interfere with proper treatment either by obstructing intra-oral cones or by being in the direct path of the beam, should be extracted before intensive radiation therapy is undertaken

Packing the infected ulcer twice daily with Z P O aids greatly in many cases By these general measures nutrition is increased, toxicity is cut down, and pain lessened Aspirin, aspirin and codeine, demerol, or even morphine may be necessary, depending upon the stage of the disease, its location and the degree of infection

Nerve injections for the relief of pain have not proved of much value in these advanced cases, probably because a multiplicity of sensory nerve fibers in several cranial nerves are affected

Intensive irradiation produces an acute skin reaction and mucositis which vary considerably in different individuals The skin reaction at its height—usually about four weeks after the beginning of treatment—is marked by a desquamation of epithelium and a weeping raw surface from which quantities of serum are exuded If this serum is allowed to dry, a crust forms over the area, with cracks, bleeding and pus formation from secondary infection The dryness can be largely overcome and relief afforded by the constant changing of vaseline or boric acid dressings These dressings are made by impregnating fine mesh gauze bandages, cut to extend over the margins of the raw surface, with melted vaseline or boric acid ointment The surface is then kept lubricated and the dried serum which remains can easily be removed with boric acid solution In the presence of mucositis, which progresses to a thick white membrane, pressure sprays of oral pentacresol or other mouth spray are useful for cleansing and relief of discomfort The constant and frequent mouth and throat douches give much relief and comfort and should be continued throughout the actual treatment and until the ulceration has healed

Proper and intelligent care of the cancer patient presupposes a knowledge of anatomy, pathology, general care, and chemotherapy, as well as radiology and surgery, and these phases must be used in conjunction with one another and at the proper time if the most satisfactory results are to be obtained

SUMMARY

The palliative care of the patient with advanced cancer of the mouth is the obligation of the surgeon in those cases in which surgery is the treatment of choice and of the radiologist in those cases which are treated by irradiation In the latter group are patients of advanced age and in poor physical condition, hopeless cases, highly malignant lesions of the posterior third of the mouth, the tonsils, base of the tongue, and the pharyngeal wall, bilateral involvement of the cervical lymph nodes and certain cases of highly malignant unilateral node involvement with fixation

The task of the radiologist is not complete with the administration of x-rays and radium but includes repeated examination, daily removal of slough, frequent packing of ulcers, institution of a proper dietary regime, relief of radiation reactions, and whatever contributes to the control of infection and the alleviation of the patient's suffering

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SUMARIO

Procedimientos Paliativos en el Cáncer Avanzado de la Boca

El cuidado paliativo del enfermo con cáncer avanzado de la boca constituye la obligación del cirujano en los casos en los que la cirugía es el tratamiento de elección y del radiólogo en los tratados con la irradiación En el último grupo figuran enfermos de edad avanzada y en mal estado físico, casos desahuciados, lesiones muy malignas del tercio posterior de la boca, las amígdalas, la base de la lengua y la pared faríngea, invasión bilateral de los ganglios linfáticos cervicales, y ciertos casos de invasión unilateral muy maligna de los ganglios, con fijación

La tarea del radiólogo no termina con la administración de rayos X y radio, sino que comprende exámenes repetidos, eliminación diaria del esfacelo, frecuente taponamiento de las úlceras, establecimiento de un régimen dietético apropiado, alivio de las reacciones a la radiación y cuanto ayude a cohibir la infección y a aliviar los sufrimientos del enfermo

DISCUSSION

(Papers by W E Costolow, Arthur S Erskine, and Grant Beckstrand)

H H Murphy, M D (Victoria, B C) Our excellent discussion of the care and treatment of advanced cancer is now before you We hope that it will stimulate further interest in these unfortunate patients It is comparatively easy to keep up interest in the acute illness which terminates in recovery or death in a comparatively short time I am sure, after listening to these papers, and especially after studying them when they appear in print, you will all agree that devotion, enthusiasm, understanding,

medical experience and judgment, specialized in terms of each individual patient, are essential to ensure that all that can be done is done in these long terminal illnesses At this point, I wish to quote from a recent article by Dr Charles L Martin of Dallas, Texas (Surgery 19 132, January 1946)

"Daland has shown that the average duration of life in untreated cancer of the breast is 40 5 months from the time of observation of the first symptoms, while 40 per cent of the patients are alive at the end of three years, 22 per cent at the end of five years, 9 per cent at the end of seven years, and 5 per cent at the end of ten years These figures indicate that in actual practice the effort expended in the care of incurable mammary cancer completely overshadows the purely surgical phase of the subject and yet the surgeons have written so prolifically about their side of the picture that the general physician who loses all interest when surgery fails is hardly to be blamed for his attitude

"Certainly more should be written about the palliative treatment of cancer, a field in which the radiologist now plays a major role Pack has recently criticized the existent attitude of both the laity and profession towards this important subject The properly treated patient with incurable cancer of the breast often has a life expectancy of from three to ten years, a great portion of which may be lived in comfort As Pack pointed out, the diagnosis of such incurable diseases as arteriosclerosis, chronic nephritis, diabetes mellitus and coronary disease is accepted with equanimity, fortitude, and optimism by most patients, whereas the term cancer tends to induce deep mental depression in both the patient and the attending physician "

Our speakers, and in fact almost all writers on the palliative treatment of cancer, have stressed the great importance of proper care in early as well as advanced cases In this connection it is interesting to note in passing that Celsus, about 25 A D , wrote as follows "There is no great danger of a cancer unless it be irritated by the imprudence of the physician " Radiologists who are caring for cancer in their daily work all realize in how many more ways the physician can be imprudent today than in the days of Celsus Every advance in both diagnosis and treatment carries with it the possibility of imprudence in application

Dr Costolow has wisely included a brief summary of the indications for treatment of pelvic cancer just to guard against imprudence of the type I have mentioned, and he has outlined what we may expect from both surgery and from radiation therapy It comforts each one of us, I am sure, that he recognizes that in spite of our best thought and care a "definite morbidity and a small percentage of mortality may be expected " I am personally very glad that he feels that a trial of radiation is worthy of consideration even in cases where there is involvement of bladder or rectum I am also pleased that he has seen fit to emphasize that those more formidable operations, as he wisely calls them, of posterior rhizotomy, anterolateral chordotomy and presacral nerve section should be left to the competent neurosurgeon Such highly trained and competent surgeons are not always available to do these operations no matter how clearly such procedures may be indicated

Dr Erskine has shown courage in stating his own position regarding the routine block dissection of the axilla Recent work done in Edinburgh and not yet published will, I think, strengthen him in the faith and add many converts His caution against surgical or radiation measures which are based on hope rather than on tried experience deserves wide and careful consideration

It was inevitable that in a discussion such as this the old problem of what to tell the patient should be given a dress rehearsal It is definitely a question for the art rather than the science of medicine My own personal guide in the matter has been drawn from one whom we think of as a poet rather than a physician—although he excelled in both fields—Oliver Wendell Holmes His dictum was that "the patient is no more entitled to all of the truth regarding his disability than he is to all of the medicine in your saddle bags—he is entitled to that part of it which will do him good "

Dr Beckstrand has given us an excellent review of the problem of cancer of the mouth and a very vivid picture of the distressing condition of the patient with advanced disease However, he has not left it at that but has outlined an active and sane program and has stated very clearly that whether the treatment be surgical or radiological, there is no room for a surgical or a radiological technician, but that the responsibility must be assumed by a true physician trained in one or other of these special branches Here again I have had the advantage of having seen Dr Beckstrand's paper before this meeting and I know how much more will be obtained from it when it is carefully read even by those who have had the advantage of hearing it this afternoon His summary of the main points in the general care of these cases is, I think, exceptionally useful

I believe that this symposium has been well worth while. If each one of us can carry away from this meeting the determination to use our present skill and knowledge to the fullest possible extent for these distressing cases and, as each case passes over from the field of the curable to what at the moment we must regard as incurable, to make certain that we do not lose contact with that patient but stand by as guide, counsellor, and friend even unto the end of life, if other members will at future meetings give us the benefit of their experience, and if our research workers will, with renewed energy both in body and soul, grapple with the immense field that is today so imperfectly understood—if all or even one of these things happen, then I am sure that Dr Costolow, Dr Erskine, and Dr Beckstrand will feel that their work has been well repaid

Henry J Ullmann, M D (Santa Barbara, Calif) The question of the treatment of terminal cancer patients has interested me very much for a number of years because, as a radiologist, I have a large number of them

I wish to add this thought to Dr Costolow's interesting paper on pelvic cancer Not all symptoms occurring in a pelvis that has been treated for cancer should be regarded as due to cancer To illustrate, one of our County Hospital patients was treated for cancer of the pelvis and a year or so later had a definite tumor It was considered a recurrence, and hopeless She died and came to autopsy Her "tumor" was a pelvic abscess, thoroughly walled off, and not cancer If an exploratory laparotomy had been done, she could have been saved

Regarding sedatives, and this also refers to Dr Erskine's and Dr Beckstrand's papers, I have found in terminal cases that one can avoid the use of morphine for a long time if one will follow this somewhat simple procedure First, when the patient is ambulatory, I use empirin compound with codein, one half grain A patient can take up to two or three of these tablets at a time, unless they cause too profuse perspiration, in which case they have to be abandoned Patients in the hospital, I put on one grain of sodium amytal, intramuscularly, every four hours around the clock That can be increased to the next sized ampule when necessary In addition to the amytal, I order a half grain of codein hypo to be repeated in an hour, if necessary If that is not sufficient, it is repeated in a half hour and, if this is still not enough, the dose is increased to one grain If the second dose of one grain of codein does not afford the help we are after, we use, within a half an hour of the last codein, one-quarter grain of morphine That quarter grain of morphine—and I never give less—on top of the codein may carry the patient for twelve to thirty-six hours without anything further, except the amytal, and that sometimes is not needed Where amytal is not being used, I employ the same method of using codein followed by morphine, and with excellent result If morphine is to be used at all, it must be given in a moderately large dose, not less than one-quarter grain If one sixth grain is used, it will have to be used more frequently and is much more apt to produce a tolerance without the desired relief of pain A larger dose of morphine, a quarter to a half grain, will carry the patient a considerable time, and the total number of grains required in twenty-four hours will be less

I was interested in Dr Erskine's statement in regard to simple mammectomy Most of the surgeons mean by simple mammectomy that the fascia is stripped off down to the muscle, and in some instances well up into the axilla I believe Dr Erskine did not suggest going into the axilla I should like very much to have the statistics on which he bases his statement.

As to telling patients of their condition, I agree with Dr Murphy—that we should tell them all that is good for them and no more Some can "take it," and it is better to give them the truth, but each patient must be judged separately

I am heartily in accord with Dr Beckstrand's paper and want to emphasize the importance of his statement that clinical judgment in late cases, and frequently in early ones, is more important than dosage magnitude I also want to emphasize the importance of using small doses for infections 75 to 125 r, measured on the skin, at a half-value layer of 1 0 mm of copper is quite sufficient for any infection If the dose is small, one can repeat more or less indefinitely That is why I wish to emphasize the value of such small doses

Hugh C Chance, M D (Cumberland Gap, Tenn) I don't know very much about this subject, but my experience goes back to the time when the surgeon removed all the breast, and then, when the cancer recurred and he knew the patient was going to die, he sent her back to "get some x-ray" This was what happened for ten or fifteen years

I want to stress one thing, which I think Dr Erskine mentioned in his discussion of cancer of the breast that is, that even in the most hopeless cases there is, once in a while, a recovery Therefore, when you begin to give x-rays in a hopeless cancer of the breast, one which according to all accounts should prove fatal inside of three or four months, and the patient begins to have some relief, take a little courage and try some more I have seen patients get well when I *knew* they were not going to get well, and stay well—not many of them, it is true, but even one in 50 amounts to something

Another thing that I want to say is that the radiation treatment, or the radiation cure, of cancer anywhere—in the mouth, in the cervix, on the breast, or anywhere else—is in the hands of the man who first treats it If he does not give enough treatment, it is bad If he lets his cone slip and gives some in the wrong place, it is bad, because it does not reach the cancer

I do not know very much about late cancer of the pelvis In fact, I have seen so many patients die that sometimes I think I don't know anything about it It is not as sure to kill as breast cancer, in my experience, but it comes next Both are very dangerous, and in both the late care is usually poor Somebody should be responsible for the care and comfort of these late cases because life may go on for years I had a patient with a cancer in the lower, inner quadrant of the breast, with an open ulcer as large as the palm of my hand when I first saw her The diagnosis was verified by the pathologist, and that woman lived eighteen years, and did washing for a living most of that time She finally died of cancer

A little dose of x-ray once in a while does wonders as far as relieving pain is concerned, and also in clearing up infection and the discharge, which is so pronounced in these ulcerated breast cases

Of the breast cases which come to me—and I see quite a few in the run of a year—about half, or at least 35 per cent, have open ulcers, broken down and discharging As far as the diagnosis is concerned, no biopsy is necessary, the odor is enough Now these cases were neglected by somebody—either by the patient or by the first doctor who saw them—or they were improperly treated Too many doctors tell you that cancer is incurable, that the patient is bound to die Well, that is a fact. We all die, but some of us live longer than others And some patients with cancer will get well and stay well You see them do it, and you can't help but instruct the general practitioner along that line

Harry H Bowing, M D (Rochester, Minn) I want to pay tribute to the essayists and especially to our Chairman for his wonderful job in summarizing these papers What I would like to leave with you is the thought that there is no place in this discussion for generalization

We, as physicians, must know the subject of late carcinoma I would like to discuss a few topics

First, are we going to tell the patient that a malignant lesion was found? In my early experience I was undecided, but today I refrain from telling patients that they have a malignant lesion I would like to relate a single experience. A patient who had carcinoma of the uterine cervix said to me "Dr Bowing, you know I have had a serious operation and you have treated me. I'm very well today, actively employed, a widow with a daughter in high school, and I think that I should know the facts about my case." I always had a feeling that I had no right to demoralize a patient, but I surely was put on the spot in this instance. I told her the diagnosis carcinoma in the neck of the womb The operation and subsequent radium treatment had proved to be very effective in her case, but instead of carrying on, she became demoralized, she wrote many letters and had many interviews Her anxiety concerning the return of the malignant lesion could not be controlled She lost interest in her health, family and position, and aged rapidly

Today, I usually permit the patient to do the talking and I supply the answers to her questions However, evasions may be necessary, especially with some patients I always plan to instruct a responsible patient concerning treatment and prognosis Everything possible should be done to reduce anxiety states to a minimum There are many facts about malignant disease that are favorable and pleasant to relate

A patient with carcinoma of the uterus may complain of a bearing down pain, or a pressure pain Investigation will reveal inadequate drainage of the uterine cavity or the presence of a pyometra A suitable catheter can be passed into the uterine cavity for drainage and irrigating purposes Other types of pain, as, for example, aching in the hip and leg usually can be allayed by the administration of mild sedatives alone or in combination with barbiturates and codein

Vaginal hemorrhage is usually due to the malignant process or irradiation therapy or a combination of both Superficial bleeding of an untreated carcinoma will usually respond to light or moderate pressure maintained by gauze packing in the vagina The packing is divided at the time of placement and removed in fractions later on More serious bleeding, due to rupture of a vaginal branch or a cervical branch of the uterine artery, will require similar treatment and increased pressure produced by continuing the gauze pack through the vaginal outlet into the separated vulva area The pack should be reinforced with a vulva pad, which should be fastened to the mons veneris and sacral area with adhesive tape An indwelling catheter is essential Radium therapy is started as soon as possible, for packing alone will not control the bleeding

Vaginal bleeding due to ulceration that occurs after irradiation therapy may be due to the malignant lesion or to an irradiation ulcer The malignant process should be controlled by the application of limited radium therapy and vaginal gauze packing as described for the treatment of superficial bleeding An irradiation ulcer usually responds to the application of petrolatum tampons Since the response is very slow, the patient is instructed to apply the tampon at least once a day until the discharge is greatly reduced In some cases radon ointment has hastened healing

Varying degrees of intestinal obstruction may occur in the late stages of carcinoma of the uterine cervix I have kept many patients rather comfortable with an adequate well balanced diet. All vegetables and fruits, cooked or raw, should be cut into cubes of 1 cm or less When necessary, oil enemas, low saline enemas, and saline cathartics should be used Colostomy is reserved for those patients with a severe or complete obstruction

I would like to encourage you to continue your interest in these patients If possible, determine the cause for their symptoms and make their last days as comfortable as you can

Wm E Costolow, M.D (*closing*) I wish to thank the men for the discussion of the paper, and I am glad Dr Bowing went into a little more detail on some of the problems of pelvic cancer

The point that I brought out and wish to stress is that these patients should be under the observation of someone who is trained in the type of treatment that they have had. We have surgeons now who are trained in radiology, and *vice versa,* but regardless of who is looking after the patient, these physicians with their experience will be able to aid the general practitioner and may even pick up some early recurrences, or be able to treat some of the complications as they arise

Arthur W Erskine, M D (*closing*) I shall try, Mr Chairman, in five minutes or less, to say

why I believe that the radical block dissection of the axilla might well be abandoned I think it is unnecessary, as I said, in the early cases, and futile in the late ones

The Mayo statistics, about twenty-five years ago, showed that if radical operation was performed in early cases—that is, cases with no palpable nodes in the axilla—64 per cent of the patients were cured The same statistics showed that 62 per cent were cured by simple amputation The Leeds statistics, at about the same time (and they were very reliable because the patients were on a panel and were kept sight of until death), showed an even smaller differential between the results of simple amputation and radical block dissection in early cases The results of simple amputation were so good that those who prepared the report felt it necessary to warn that they should not be used as an argument for not performing the so-called "complete' operation

It is true, of course, that if we have a hundred patients whose cancer appears to be confined to the breast, and do a radical block dissection on all those patients, we will find carcinomatous nodes in approximately sixteen of them It is also believable that, had all these hundred patients been subjected to an extremely careful and radical dissection, the lives of four or five of the sixteen might have been saved But, could 100 patients with early cancer have been subjected to a radical operation at the same time that they would submit to a simple amputation? I think not

In the advanced cases—and when I say "advanced cases, I mean those in which the disease has advanced into the axillary lymph nodes—if we operate and do nothing else, we can expect, in the hands of very skillful surgeons, approximately 20 cures out of 100 cases How about the other 80? A great many of them will have edema, they will have neuritis, they will be uncomfortable, they will have loss of function And of that 80 who die, a great many will die *not* from local recurrence, *not* from axillary recurrence, but from distant metastases Their lives are lost regardless of what was done when they came to operation

I have had a very happy experience in observing the results of a large number of simple amputations About thirty years ago I had the temerity to say, in my county medical society, what I am saying here, and to my surprise and delight, I found that several of my colleagues agreed with me One in particular, Dr Charles S Krause, a brilliant and extremely popular surgeon, then abandoned the block dissection He contents himself with an amputation and with the removal of the obviously involved, invaded carcinomatous nodules in the axilla, or with the removal of persistent nodes, following preoperative irradiation All his patients, regardless of the stage of the disease, are subjected to routine postoperative x-ray therapy In all who have not passed the menopause it is induced

A recent study of his cases, not yet completed, concerned the end-results in patients treated longer ago than five years It shows a five-year survival in the early cases of approximately 90 per cent But the amazing thing is that less than 60 out of 100 of his advanced cases—that is, patients with axillary metastases—died of cancer And a great many of those who died, died, as I said, of distant metastases

There are many reasons why women postpone operation for cancer As Claudius said "O Gertrude, Gertrude, When sorrows come, they come not single spies, but in battalions" And it always seems to be that way When we say "Well, we have an early case, now is the time to cure it if it should be cancer," there are so many things to postpone that operation There is no money, the daughter or the son must finish this year of high school, and then, perhaps more than anything else, there is fear—fear because of friends who have had extremely uncomfortable times following a radical operation, with edema, loss of function, pain, and all the things that go with an unsuccessful radical amputation I believe that fear of the radical operation has a great deal to do with postponing an exploratory operation

Why must we always insist upon doing what is, theoretically, the best possible thing for every patient, when we know that many times our insistence merely means that nothing will be done, or can be done, for that individual patient? Why can we not agree with a great man who said, "To accomplish anything worth while it is necessary to compromise between the ideal and the practical?"

Pulmonary Disease in Workers Exposed to Beryllium Compounds Its Roentgen Characteristics[1]

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Tulsa, Okla

SINCE 1943 WE have had the unusual opportunity of examining the chest films of many individuals who had been exposed to beryllium compounds in the form of dust, with pulmonary changes consisting in a bilateral diffuse nodular infiltration The majority of these persons were or had previously been employed in plants making electric and fluorescent lamps A few were engaged in the manufacture of beryllium copper alloy Occupational histories have strongly suggested beryllium as the probable offending agent, especially in those workers who handled the fluorescent powder or came into contact with dust containing beryllium

The late Dr Leroy U Gardner was intensely interested in the intriguing problem of detecting the agent responsible for the lung lesions in these patients Among the possibilities which he had under suspicion and investigation, in addition to beryllium, were the diphtheroid, virus and fungus infections, sarcoidosis of unknown etiology, silicosis, and exposure to other elements such as phosphorus, zinc, manganese, and copper While he was not prepared actually to condemn beryllium, he definitely felt that it was in some as yet unrecognized manner involved It was on his suggestion, made several months before his death, that the roentgen study of these interesting and unusual cases was undertaken, with the purpose of describing the findings, attempting a correlation with the clinical course of the disease, and finally considering the differentiation from other similar pulmonary changes

CLINICAL FEATURES

The following is a brief summary of the clinical findings obtained from the abundant correspondence concerning 32 cases in Dr Gardner's files Four additional cases referred to Saranac Lake for thorough study, and described below, will be included in a subsequent clinical report by Dr George Wright Recently, Hardy and Tabershaw (11) adequately described the clinical manifestations of a group of patients, many of whose chest films we were privileged to review

The patients were preponderantly females, due to the higher ratio of females to males employed in the plants where most of the cases developed The ages varied from twenty-one to forty-three years, with an average of twenty-nine years The average duration of exposure was sixteen months An interesting feature, as pointed out by Hardy and Tabershaw (11), is the delay in onset of symptoms These appeared, or the first positive x-ray evidence was discovered, twenty-four months (average) following change of job or cessation from the supposedly hazardous operation Dyspnea, cough, and weight loss were the most frequent symptoms, fatigue, lassitude, anorexia, and low-grade fever were also occasionally present

The physical findings were limited to impaired resonance of the chest and fine râles throughout the lungs Cyanosis was present in several patients There was no involvement of the peripheral nodes, nor any consistent enlargement of the liver or spleen Two of the patients (Cases 1 and 4, reported below) had papules on the dorsum of the hands, which on biopsy showed "sarcoid-like lesions"

The laboratory findings were meager A brief summary of the observations in the four patients studied here follows

[1] From the Department of Roentgenology of Trudeau Sanatorium and the Edward L Trudeau Foundation, Saranac Lake, N Y Accepted for publication in March 1947

All had polycythemic red counts The white cell count, the differential count, and the sedimentation rates were not unusual Invariably all tests, including sputum smear and culture, ruled out tuberculous infection Blood chemistry was not notable except for an elevated serum alkaline phosphatase in Cases 1 and 4 Ventilatory function tests, performed by Dr George Wright, confirmed respiratory disability and established the polycythemia as secondary to the pulmonary lesions Roentgen studies of the skeleton revealed no destructive or inflammatory process The possibility of bone change has not been conclusively ruled out, however, in view of the elevated alkaline phosphatase in the two cases mentioned above It is to be noted that Dr Gardner was able to produce bone sarcoma in rabbits by the intravenous injection of beryllium oxide and zinc beryllium silicate

The clinical course in the 32 cases has varied Following an illness of about two years' duration, some patients died from the disease Hardy and Tabershaw (11), in their series of 17 cases, reported a mortality rate of 35 per cent In the group which we reviewed, many patients improved and, though not completely free of symptoms, continued working at some other job Where follow-up was possible it was found that 30 per cent had died, 30 per cent were unimproved or became slightly worse, and 40 per cent were improved What the eventual outcome will be in those living with persistent pulmonary changes is not known, since insufficient time has elapsed for conclusions to be drawn

The lungs from several fatal cases were sent to Dr Gardner for pathological study In all, the predominant finding is a granulomatous reaction infiltrating or completely obliterating the interstitial tissue The granuloma consists of conglomerate masses and, in some cases, of foci of dense hyaline material and cellular infiltration of lymphocytes, plasma cells, and macrophages Many multinucleated giant cells with or without various inclusion bodies are present The mediastinal nodes are infiltrated in some cases by a similar granulomatous process

ROENTGENOLOGICAL OBSERVATIONS

Reports of roentgen observations of the lungs of workers exposed to beryllium compounds are few in number (1, 9, 10, 11, 15, 16, 22, 23) Gelman (9) describes "small-noduled infiltrations" similar to those seen in the "small-noduled" pneumoconioses and miliary tuberculosis Possibly suspecting an irreversible reaction, he also speaks of a "pneumo-sclerosis with all the consequences which may arise from it" He attributes the above changes to the fluorine vapor of beryllium oxyfluoride Berkovits and Izrael (1) stress the importance of serial roentgenograms in the diagnosis of beryllium fluoride intoxication Meyer (16) describes a roentgenological pattern suggestive of pulmonary edema, occurring within one to two months after initial employment in the beryllium industry Van Ordstrand *et al* (22) found a chemical pneumonia in workers extracting beryllium oxide from ore There was a diffuse haziness suggestive of pulmonary edema, together with soft irregular areas of infiltration, which were followed by the appearance of small discrete nodules throughout both lung fields In one patient the changes were typical of silicosis, but the shadows subsequently disappeared

Kress and Crispell (15) reported four cases of chemical pneumonitis following exposure to fluorescent powder containing beryllium carbonate and beryllium manganese silicate Of interest in their report is the fact that two patients showed clinical improvement and clearing of the abnormal shadows in the chest films The other two patients had abnormal shadows but had no symptoms

The most recent report is that of Hardy and Tabershaw (11) Without indicting beryllium, these authors describe a delayed chemical pneumonitis in employees of a concern manufacturing fluorescent lamps Sosman and Wilson, who re-

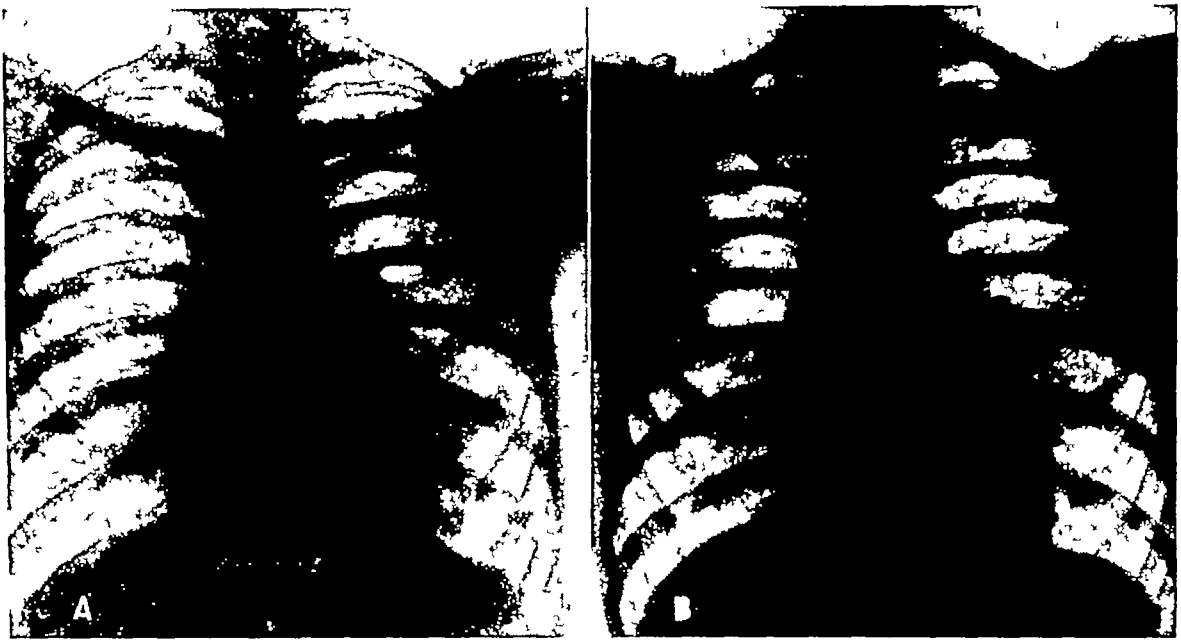

Fig 1 A male, aged 28 years, employed in a fluorescent lamp plant since March 1941 Onset of dyspnea in December 1941 and weight loss in December 1942 A film was first reported as showing fine stippling in May 1943
A October 1943 Granular type of nodulation and enlargement of hilar nodes
B November 1944 Definite clearing Faintly visible reticular pattern

viewed the films in this group, divide the roentgen manifestations into three stages (1) granular, (2) reticular, and (3) nodular The latter authorities feel that the first stage is not suggestive of any other disease entity in their experience

Our series consisted of 32 cases for which chest films, along with pertinent data, were referred to us for review In the 4 cases reported below, the extremities, skull, and spine were examined radiographically, but with negative results In all, the pulmonary process was well developed and consisted of a widespread fine to punctate and coarsely nodular infiltration, involving both lungs uniformly, the apices and costophrenic sulci were generally free The intensity of the shadows was usually greater in the middle third of the lung fields

Depending upon the size and intensity of the shadows, we have classified the infiltration into two types, granular and nodular In the granular type, the infiltrate may be so fine and diffuse as to present a stippled or "sandpaper" appearance, occasionally, on stereoscopic examination, one may visualize an associated reticular pattern Not infrequently, as a result of coalescence in the middle third of the lung, the shadows may become densely

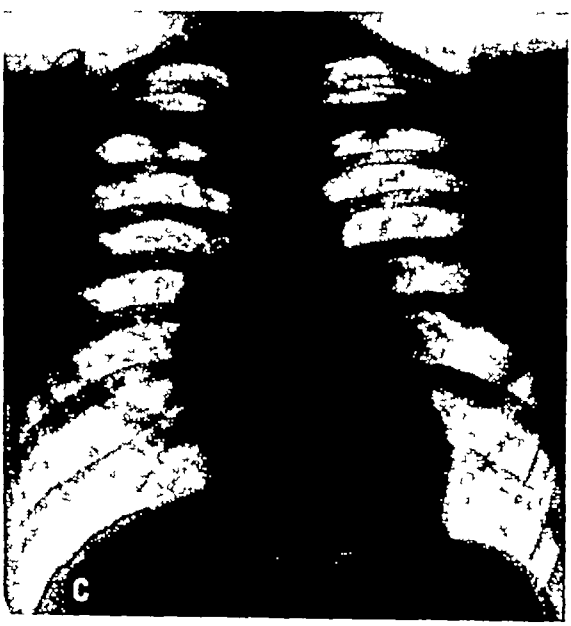

Fig 1 C August 1945 Further but not complete regression Very fine stippling and enlarged hilar nodes persist

confluent, obscuring the granularity and reticulation in this area In the nodular type, the individual infiltrates are larger and coarser, discrete, and less numerous, measuring up to 4 or 5 mm in diameter On the same film they vary little in size, are distributed symmetrically, and may be coarse or smooth in outline Tendency to confluence is considerably less in the upper lung fields, although concentration and coalescence may be present

The vascular markings are obscured, except at the base, in the advanced cases they may be obliterated Mediastinal widening occurs, though this is not a striking feature It results from lymph node enlargement, which is present to some degree in the majority of cases and can be demonstrated in planigraphic films The heart may be enlarged, in the granular type the cardiac border is blurred

Concerning the eventual end-result of the lesions in the lungs, little can be stated at this time, since in the cases which have come to our attention roentgen observation has been of too short duration to allow of adequate study and definite conclusions In some, the lesions have been slowly progressive, with death from respiratory and cardiac failure In others the lesions have shown a surprising stability over a period of two to three years Rarely is there a spontaneous and complete disappearance of the pulmonary infiltration More common is a notable clearing, but with persistence of very fine nodulation (Fig 1, A-C)

CLINICAL CORRELATION

In correlating the clinical features of the disease process with the roentgen appearance of the lesions, one is soon impressed with the futility of attempting to draw any clear-cut conclusions In the first place, there is as yet no conclusive proof that the same specific factor or combination of factors is responsible for the roentgen changes seen in these 32 cases Secondly, a long enough interval has not elapsed to warrant any opinion as to whether the disease is cured or simply stationary Partial or complete clinical remission has occurred without proportionate roentgen improvement Thirdly, well developed lesions can be demonstrated in workers without symptoms, as seen in three of our cases and in the two reported by Kress and Crispell (15) It is our impression, however, at the moment, that the granular lesion is more serious, since the symptoms are more severe in this type of involvement The presence or development of confluent shadows, with increase in severity of the symptoms, would seem to indicate a less favorable outlook With this exception, one might safely state that the roentgen appearance and stability of the lesions are of no definite prognostic import Unquestionably, the prognosis must be guarded when the pulmonary lesions persist despite the clinical improvement, and it is in these patients that extended observation is imperative

CASE HISTORIES

CASE 1 A white male, aged 29 years, a foreman, was admitted April 6, 1945, complaining of cough and dyspnea In November and December of 1942 his work had consisted of manually sifting fluorescent powder His present illness began in December 1942 with shortness of breath, productive cough, anorexia, and slight fever A film on Jan 16, 1943, revealed abnormal shadows in the lungs With treatment and cessation from work the patient improved He was transferred to another plant in April 1943 as outside maintenance man, away from the dusty environment A film taken on Nov 11, 1943, showed clearing (Fig 2, A) In December 1944, however, arthralgia, paresthesia, and anorexia developed Cough and dyspnea also recurred, along with fever and night sweats A film taken on Feb 27, 1945, showed that abnormal shadows had reappeared in the lungs These had progressed so that an admission film on April 7, 1945 (Fig 2, B) revealed rather extensive involvement The patient appeared chronically ill, with a temperature of 103 6° Fine and moderately coarse râles were heard bilaterally Otherwise no significant findings were present

Laboratory findings were as follows red blood cells 6,190,000, hemoglobin 88 per cent (12 76 gm), white cells 12,800 (polymorphonuclears 76 per cent, lymphocytes 16 per cent, monocytes 5 per cent, eosinophils 2 5 per cent, basophils 0 5 per cent), sedimentation rate (Cutler method) 4 mm, total proteins 6 3 per cent, albumin 4 3 per cent, globulin 2 0 per cent, A/G ratio 2 1, non-protein nitrogen 33 5 mg, blood sugar 100 mg, serum calcium 10 1

FIG 2 Case 1 A Nov 11, 1943 Lungs have cleared after previous demonstration (Jan 16 1943) of fine stippling and partial obliteration of vascular markings Pulmonary markings now well seen
B April 7, 1945 Development of confluence bilaterally

mg , serum phosphatase 2 7 mg , alkaline phosphatase 21 and 23 King-Armstrong units, uric acid 5 3 mg , cholesterol 153 mg Agglutination tests for *B typhosus*, paratyphoid A and B, *B dysenteriae*, the Flexner bacillus, and *B abortus* were negative Skin tests with brucella vaccine (1–100) and with 10 mg O T were negative Concentrated smears and cultures of the sputum showed no tubercle bacilli, and were negative also for spirochetes on several occasions Diphtheroid organisms were found in the blood and sputum The urine was negative Biopsy specimens from bronchus, muscle, and axillary node were negative, a papule on the dorsum of the hand showed a "sarcoid-like" lesion with central necrosis (Dr L U Gardner) Ventilatory study showed diminished vital capacity and respiratory disability X-ray studies of the gastrointestinal tract and gallbladder were negative.

Despite treatment of many types, including streptomycin, the patient's temperature remained high and he continued to lose weight. X-ray study (Fig 2, C) showed slight increase of the disease, and his condition was unchanged on discharge, Oct 6, 1946

FIG 2 C Oct 4, 1946 Further increase of confluence with diminution of air-containing lung space

CASE 2 A white male, aged 37 years, a maintenance mechanic, was admitted March 4, 1946, complaining of shortness of breath From 1939 to 1943 he had operated exhaust machines for fluorescent tubes For two years during this period he made daily visits to the powder room In 1943 he was transferred to the department manufacturing radar and incandescent tubes His present illness began about April 1945, with anorexia 20-pound weight loss, unproductive cough, and dyspnea In August 1945, dyspnea was severe enough for him to consult a physician, who found him "perfectly well" Following a positive chest x-ray examination in October 1945, the patient was hospitalized for ten days and tuberculosis was ruled out Upon his return to work he contracted a cold, with persistence of symptoms described above X-ray examination on Dec 5, 1945, still showed changes in the lungs (Fig 3, A),

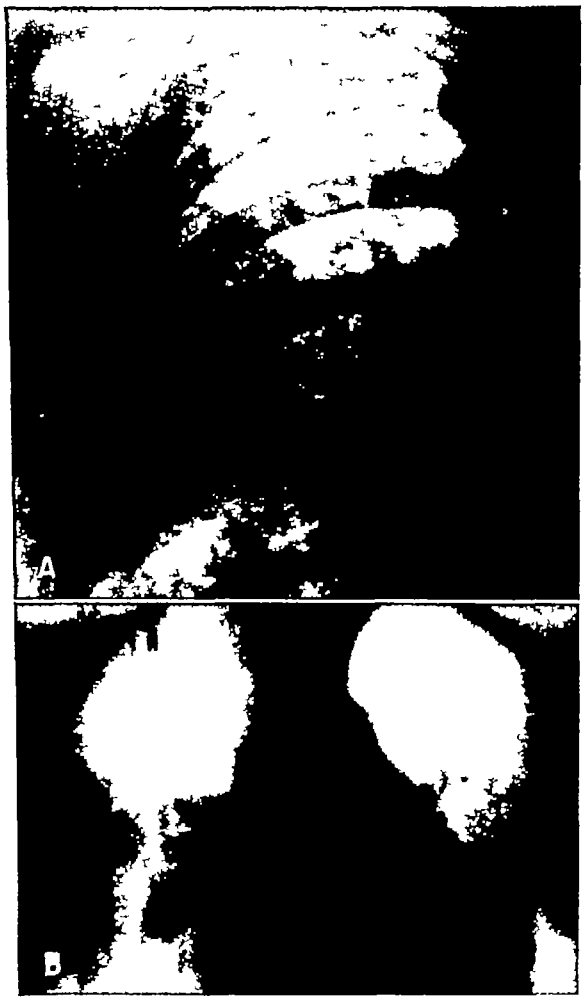

FIG 3 Case 2 A Dec 5, 1945 Contact film of right hemithorax, showing generalized fine nodulation with suggestion of reticulation Early tendency to coalescence in lower halves of lung fields Vascular markings obliterated Hilar enlargement and blurring of left heart border The lungs had been reported normal in 1944
B Planigram showing enlargement of hilar nodes

and he was readmitted to the hospital for a needle biopsy of the lung, which revealed "chronic pneumonitis" Shortly afterward he was referred to Trudeau Sanatorium

On admission, there was noted evidence of weight loss and cyanosis of the lips, nose, ears, and fingers on moderate exertion Breath sounds were impaired bilaterally A chest film showed findings unchanged from those of Dec 5, 1945 Hands and feet and gastro intestinal tract showed nothing unusual On fluoroscopy the heart appeared enlarged to the left Planigrams (Fig 3, B) revealed mediastinal node enlargement

Laboratory findings were as follows red blood cells 7,650,000, hemoglobin 140 per cent (20 3 gm), color index 0 91, white cells 7,100 (polymorphonuclears 58 per cent, lymphocytes 23 per cent, monocytes 15 5 per cent, eosinophils 3 per cent, basophils 0 5 per cent), volume index 0 84, saturation index 1 03, hematocrit 62 per cent, sedimentation rate (Cutler method) 0 5 mm , total proteins 7 86 per cent, albumin 4 94 per cent, globulin 2 92 per cent, A/G ratio 1 68, non-protein nitrogen 33 7 mg , serum alkaline phosphatase 8 27 King-Armstrong units The urine was negative The sputum (smear and culture) was negative for tubercle bacilli A positive skin test was obtained with 1 mg O T Ventilatory tests showed over-breathing in response to exercise, with a polycythemia secondary to respiratory disability The course in the sanatorium was uneventful, and the patient was discharged on April 5, 1946, his condition and x-ray findings unchanged.

CASE 3 A white male, aged 36 years, was admitted June 25, 1946, with languor and cough. He commenced working in a fluorescent plant in 1942, examining fluorescent tubes Fluorescent powder in lacquer suspension reached the coating room, where he spent a small percentage of his time From early 1944 to August 1945 his duties necessitated spending approximately twenty minutes daily in the powder room From August 1945 to December 1945 he opened fluorescent Christmas-tree lights, under air-pressure His present illness began with herpes zoster and weight loss in mid December 1945 Upon returning to work following a period of treatment at home, he began to notice gradually increasing dyspnea on exertion Productive cough, headaches, and fatigue developed in April 1946 Following a positive chest x-ray examination in June 1946, he was referred to Trudeau

On examination, the patient appeared pale and chronically ill Physical findings were limited to fine inconstant râles over the entire chest X-ray examination on June 25, 1946 (Fig 4, A and B) showed pulmonary changes Hands, feet, and gastro-intestinal tract were normal roentgenographically Planigraphic studies (Fig 4, C) revealed definite hilar node enlargement

Laboratory findings were as follows red blood cells 7,980,000, hemoglobin 123 per cent (17 83 gm), white blood cells 6,700 (polymorphonuclears 56 per cent, lymphocytes 30 per cent, monocytes 8 per cent, eosinophils 5 per cent, basophils 1 per cent), volume index 0 81, saturation index 0 94, hematocrit 61 per cent, sedimentation rate 6 mm , total proteins 7 67 per cent, albumin 5 28 per cent, globulin 2 39 per cent, A/G ratio 2 2, non-protein nitrogen 44 8 mg , blood sugar 88 7 mg , alkaline phosphatase 10 26 King-Armstrong units The urine was negative, as was the skin reaction to 10 mg O T Sputum (smear and culture) showed no tubercle bacilli Ventilatory function tests revealed respiratory disability as manifested by diminished vital capacity, severe emphysema with high residual air, poor lung ventilation, and secondary polycythemia

The clinical course was uneventful, and the patient was discharged on July 11, 1946, slightly improved

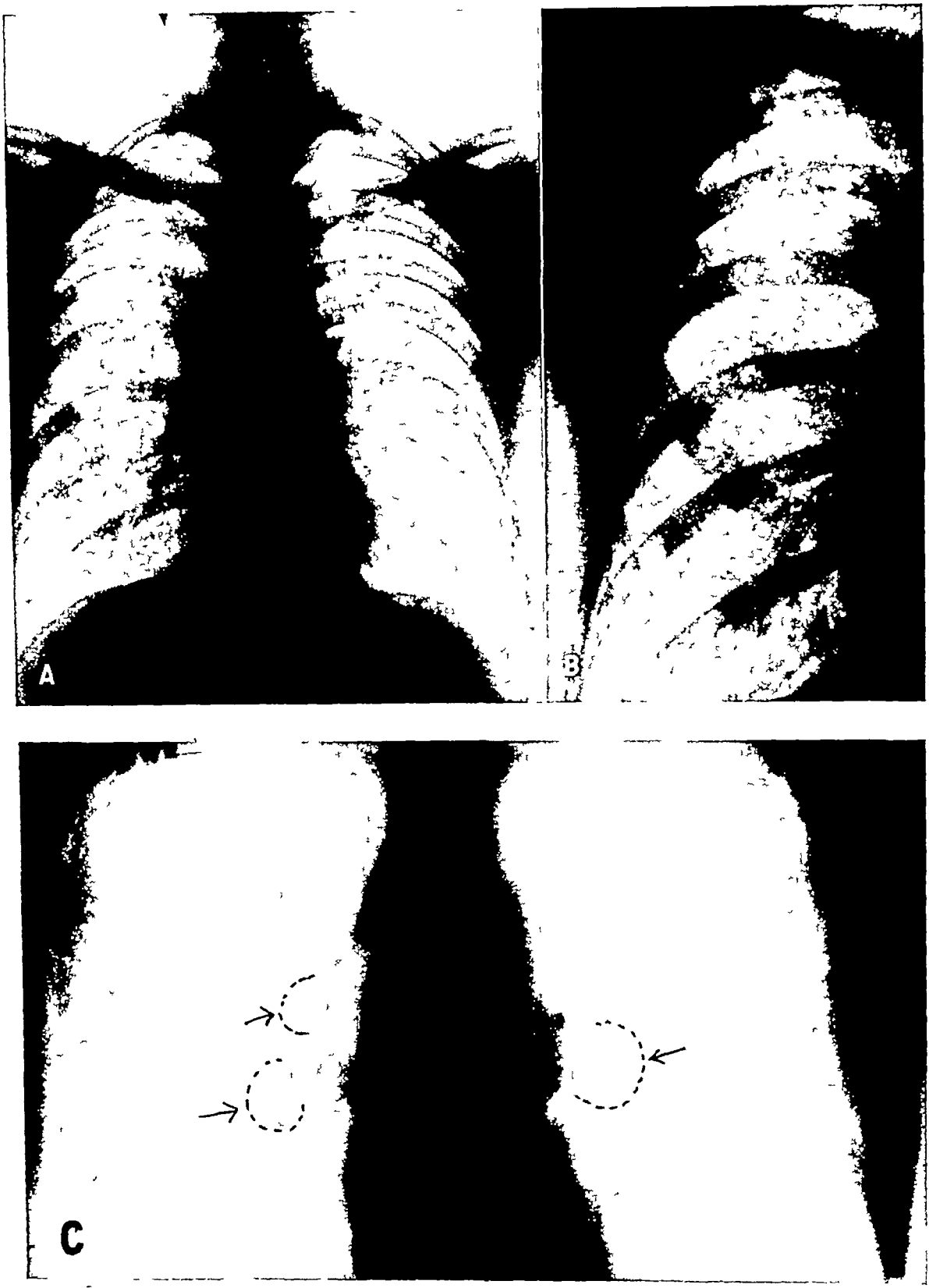

Fig 4 Case 3 A June 25, 1946 Generalized diffuse granular infiltration, having a reticular pattern Vascular markings in upper lung fields obliterated Lungs were reported normal July 18, 1943
B Contact print of right hemithorax
C Planigram showing hilar nodes

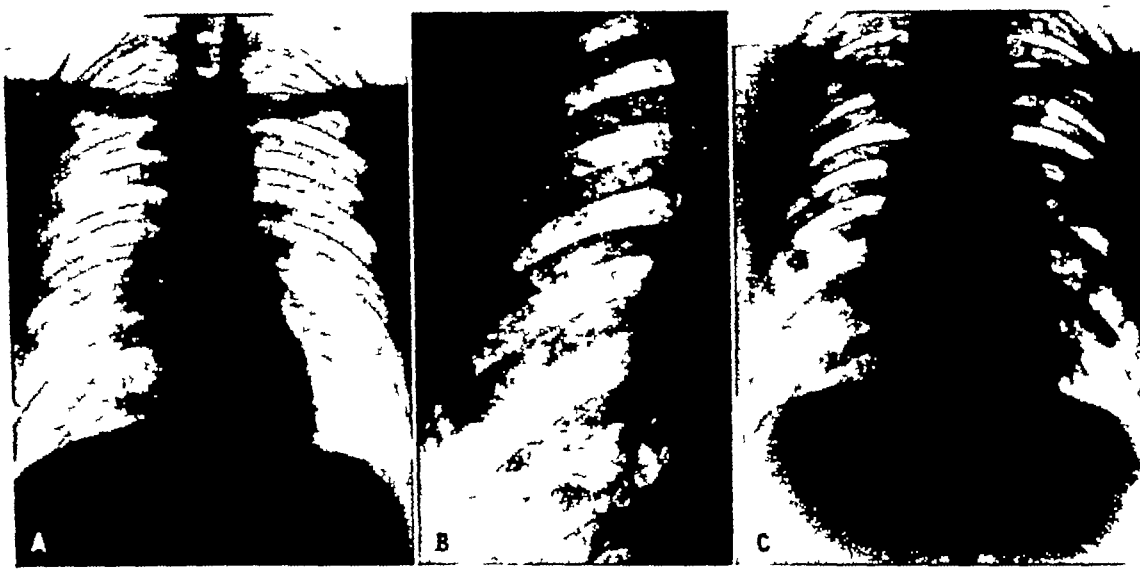

FIG 5 Case 4 A April 25, 1946 Diffuse coarse nodular infiltration throughout Faintly visible background of fine stippling Right hilar nodes enlarged
B Contact print of right hemithorax
C Sept 5, 1946 Development of dense irregular shadow in left lung field

CASE 4 A white male, aged 33 years a tool and method-planning man, was admitted on May 3, 1946, complaining of a 30 pound weight loss and shortness of breath In September 1940 he began work as a coater of fluorescent tubes, from March 1941 to mid April 1941 he worked with fluorescent lamp solution, after which he transferred to another concern, working on electric motors and as a tool and method planner His present illness first became obvious in August 1945, with dyspnea, weight loss, slight productive cough, occasional headaches, and palpitation, he also noticed the development of papules on the dorsum of the hands On physical examination there was evidence of weight loss, cyanosis of lips, fingers, and hands, small bilateral palpable inguinal nodes, and dusky purplish papules 1 to 3 mm in diameter on the dorsum of both hands and fingers Fine râles were heard at both apices A chest film taken April 25, 1946 (Fig 5, A and B) revealed lung changes Roentgenographic examination of hands, feet, skull, and gastro-intestinal tract was normal

Laboratory findings were as follows red blood cells 7,420,000, hemoglobin 138 per cent (20 01 gm), color index 0 93, white blood cells 6,800 (polymorphonuclears 48 per cent, lymphocytes 30 per cent, monocytes 18 per cent eosinophils 3 5 per cent, basophils 0 5 per cent) volume index 0 94, saturation index 0 93, hematocrit 66 5, sedimentation rate (Cutler method) 1 mm total proteins 6 68 per cent, albumin 4 43 per cent globulin 2 25 per cent, A/G ratio 1 9, non protein nitrogen 33 1 mg , serum calcium 10 2 mg serum phosphorus (inorganic) 3 7 mg , alkaline phosphatase 22 38 and 21 8 King-Armstrong units The urine was negative An electrocardiogram was normal The sputum (smear and cultures) was negative for tubercle bacilli The skin was negative to 10 mg O T Biopsy of skin papules (Dr L U Gardner) showed sarcoid with hyaline necrosis Ventilatory tests revealed over-breathing in response to exercise, a slightly elevated residual air, abnormal lung mixing, and evidence of mild emphysema

The patient was discharged May 29, 1946, his condition and x-ray findings unchanged. Follow-up revealed that he recently had an acute exacerbation, from which he recovered A film taken Sept 5, 1946, showed change (Fig 5, C)

ROENTGEN DIFFERENTIAL DIAGNOSIS

When, in the roentgenogram, one sees disseminated fine and coarse infiltration of the lung parenchyma, one must of necessity consider all disease processes which are capable of producing such a picture This is particularly imperative in the presence of pulmonary changes such as we have described, the etiology of which, though suspected, is still in the realm of conjecture and experimentation

No disease is as yet identified which can exactly duplicate the bilateral diffuse stippling or "sandpaper" pattern characteristic of the early stage of chronic beryllium disease as we have seen it Nevertheless, a few produce lesions which are so nearly identical that they deserve mention Confusion arises more frequently with

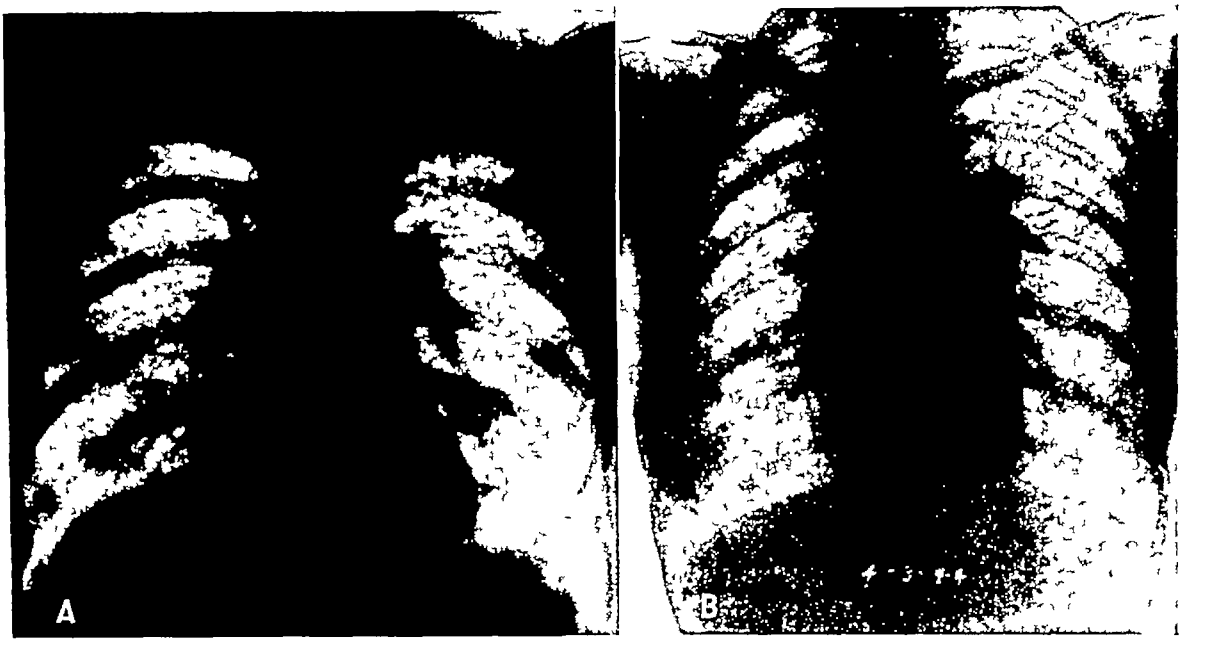

FIG 6 A Film of an iron-ore miner showing bilateral nodulation of uncomplicated second degree silicosis, with complete obliteration of lung markings and basal emphysema No symptoms
B Female, aged 27 years, employed in a fluorescent lamp factory from July 1940 to April 1943 Symptoms consisted of dyspnea, weight loss, dizziness, and headaches Film (June 22, 1943) shows bilateral uniform nodulation with obliteration of vascular markings Right hilar enlargement

those diseases which give rise to the larger discrete nodular infiltration

Pneumoconiosis The roentgen differentiation from the majority of the specific pneumoconioses is dependent entirely upon the occupational history In uncomplicated silicosis (Fig 6, A) the x-ray findings may be quite indistinguishable from the nodular infiltration of beryllium granulomatosis (Fig 6, B) The nodules in the latter are somewhat coarser and softer, they may regress but rarely completely disappear There is no resolution or roentgen improvement in silicosis Of interest clinically to the roentgenologist is the fact that for a comparable degree of pulmonary change, respiratory disability is absent in simple silicosis, whereas it may be most pronounced in beryllium disease

Perhaps the specific pneumoconiosis which most closely approximates the roentgen picture of the early stage of delayed chemical pneumonitis is that found in workers exposed to tremolite talc powder Siegal, Smith and Greenburg (20) reported such a group, in whom they found a pulmonary fibrosis demonstrable as a fine, diffuse, and in some cases distinctly granular, infiltration Also included were a few with nodulation which might be confused with silicosis Porro, Patton, and Hobbs (17) described the development of confluent shadows as evidence of advancement of the disease in another group of workers similarly exposed

In chronic "welders' disease," Enzer and Sander (6) have shown that generalized, discrete, soft, round shadows may occur throughout the lungs from exposure to fumes containing over 90 per cent iron oxide (Fe_2O_3) These changes, according to Sander (19), may persist for many years even after exposure is eliminated

Dunner, Hermon, and Bagnall (5) described shadows in the lungs of radiator and boiler finishers, due to inhalation of dust containing carbon, iron, and silica In the early stage, there is reticulation of the fine parenchymal architecture, this progresses to a bilateral, symmetrical fine mottling, especially marked in the middle and lower thirds Occasionally larger opaque patches are seen, the result of confluence

Fig 7 Asbestos worker, aged 62 years exposed 22 years Film shows 'ground glass' appearance of lower halves of the lung fields, with obliteration of vascular markings Heart is enlarged

The picture of asbestosis is seldom confused, since in the early stages the findings are minimal and hardly detectable In well advanced asbestosis (Gardner, 8, Shull, 21), the lower halves of the lung fields are obscured by a uniformly fine granular shadow, having a "ground-glass" appearance (Fig 7) Radiating outward from the heart border are heavy linear strands, giving rise to the "porcupine heart" effect If roentgen differentiation is not possible, the exposure history suggests the correct diagnosis

Boeck's Sarcoid Boeck's sarcoid may frequently appear as a diffusely disseminated nodular involvement of the lungs Reisner (18) has seen this form in one-third of his cases When the distribution of the sarcoid lesions is bilateral and symmetrical, and there is confluence together with lymph-node enlargement, differentiation is quite difficult Both diseases may evidence chronicity, but the likelihood of complete regression is greater in Boeck's sarcoid Differentiation may then rest solely on the occupational history and clinical findings Sarcoidosis is a systemic disease, consequently peripheral node, skin, or bone involvement may be expected However, too much significance should not be placed on the absence of bone lesions, since King (14) has seen cystic changes in only 10 per cent of Boeck's sarcoid, productive changes may be present in an additional 10 per cent

Chemical Pneumonitis As the result of inhalation of fumes, there may appear a widespread pneumonitis, which has a diffuse nodular character With prompt elimination of the offending vapor, these shadows quickly regress The beryllium poisoning cases of Gelman (9) and Van Ordstrand *et al* (22) were of this type Camiel and Berkan (2) observed a similar picture after exposure to nitric fumes, with rapid regression No doubt, inhalation of other chemical fumes similarly affects the lungs In the acute poisoning cases the lungs will show a generalized haziness, but differentiation from the delayed form of chemical pneumonitis is possible only on serial roentgen studies

Tuberculosis In miliary tuberculosis, the nodules are numerous, discrete and widespread, but never is there a granular background (Fig 8, A) These miliary shadows are indistinguishable from the small nodular type of infiltration seen in the beryllium cases (Fig 8, B) If the patient is acutely ill, or tubercle bacilli are isolated from the sputum, or a cavity is seen in the roentgenogram, the diagnosis is tuberculosis

Tuberculosilicosis It is conceivable that tuberculosilicosis (Fig 9) may be confused with the beryllium cases which show large confluent shadows (Fig 2, B) In the former, the borders of the conglomerate shadows are well circumscribed and do not extend to the periphery of the lung, with active infection, the density of the shadows becomes patchy

Bronchomycoses Fungus infection is always suspected when the pulmonary pattern is non-specific and when no definitive diagnosis can be made clinically, but proof is not easily forthcoming Monil-

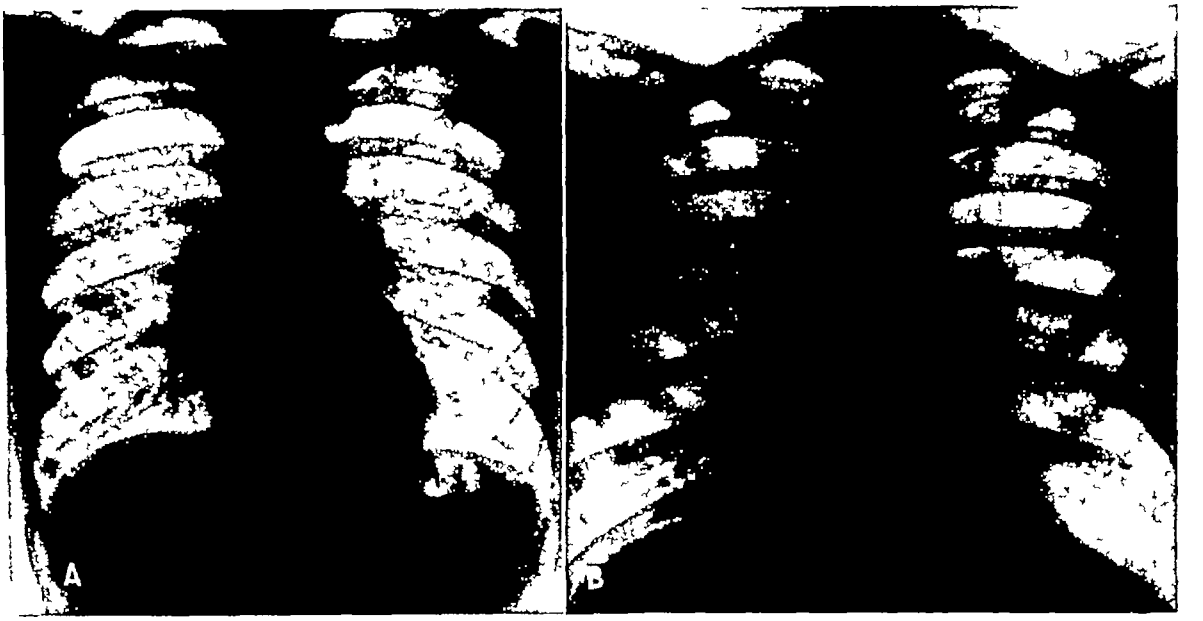

Fig 8 A Miliary tuberculosis Film shows fine discrete uniform bilateral nodulation Active tuberculous lesion in right lower half
B Male, aged 31 years, with two years' exposure in fluorescent lamp factory with total length of service of 9 years Film reveals very small nodular or granular infiltration, which is bilateral and diffuse Peritruncal shadows obliterated Definite hilar enlargement

iasis (Carter, 3) may show extensive linear shadows radiating out from the lung roots, or miliary foci which tend to be large and discrete The second stage of aspergillosis (Fawcitt, 7) may reveal a widely distributed mottling, most pronounced in the lower two-thirds of the lung fields This mottling is not sharply defined and has a "snow-flake" appearance Carter (3) states that the pulmonary manifestations of coccidioidal granuloma may be varied Twenty per cent of his cases showed "mottling" throughout, others, sharply circumscribed discrete miliary shadows, and some, scattered coarse nodular or hazy foci Hilar involvement was quite pronounced and often extensive Differentiation of this group may not be possible roentgenologically, and may be dependent wholly upon the absence of a history of exposure to beryllium compounds Sensitivity tests with the fungus isolated from the patient, together with favorable therapeutic response to iodides, will exclude beryllium poisoning

Cardiovascular Disease The pulmonary changes arising from cardiovascular disorders are less likely to cause confusion because of the clear-cut clinical picture These changes are characterized by linear exaggeration of the vascular markings,

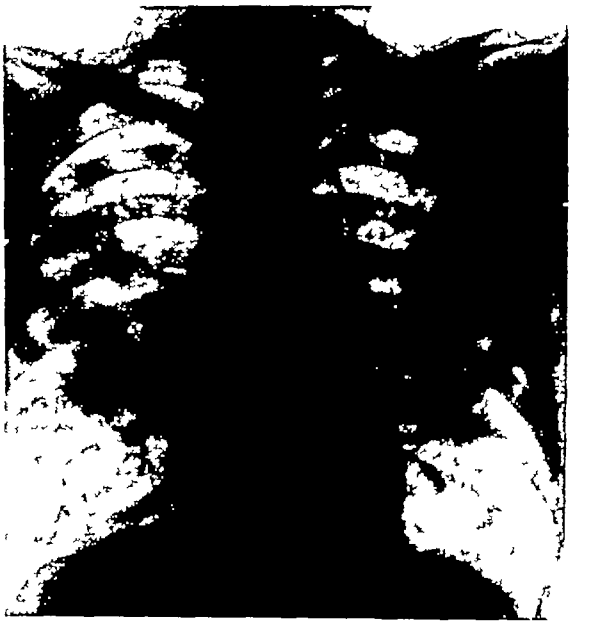

Fig 9 Tuberculosilicosis Film shows conglomerate fibrosis of upper third bilaterally and patchy density in lower two thirds bilaterally Nodulation barely visible at bases, which are emphysematous

occasionally visualized as a bilateral diffuse symmetrical pseudo-nodulation, limited to the mid and peripheral zones When vascular fibrosis is present, the lesions are irreversible, in its absence, there is progression or regression, depending upon treatment and upon the severity of the disease In mitral stenosis (Hurst, Bassin, and Levine, 12) and in coronary artery disease with congestion, fluffy densities are present which may subsequently disappear, more often there is linear and dense mottling, which may be permanent A mitral configuration and enlarged heart serve as clues to the correct diagnosis Rarely scleroderma heart disease (Weiss, Stead, Warren, and Bailey, 24) may exhibit a diffuse mottling or granularity throughout, sparing the apices A triangular enlarged heart shadow, the clinical history, and skin changes should exclude lesions due to beryllium compounds

Miliary Carcinosis Metastatic carcinoma (Culver, 4) or lymphangitic extension of a primary pulmonary lesion may be apparent as diffuse infiltration of irregular density and asymmetrical distribution The individual nodules, which are very poorly demarcated and vary from 1 to over 10 mm in diameter, always progress and have a tendency to conglomeration

Erythema Nodosum Kerley (13) has described two types of pulmonary change in erythema nodosum (1) round foci, which are larger and denser but less numerous than those of miliary tuberculosis, portions of the lung fields may be involved, without coalescence but with focal areas of atelectasis, (2) coarse reticular striations radiating out from the hila and diminishing in size toward the periphery If pulmonary involvement is not uniform or intense, beryllium pneumonitis may be excluded

SUMMARY

1 A brief summary of the clinical data accompanying the chest films of 32 patients who were exposed to dust of beryllium compounds and in whom delayed pulmonary changes developed is presented The pathological changes in several autopsied cases are briefly described Four patients were thoroughly investigated and their histories are presented

2 The roentgen findings are limited to the lungs and are characterized by (1) a bilateral, uniformly widespread, diffusely granular and/or (2) nodular infiltration No definite disease entity is known which can produce the fine disseminated granular type of infiltration observed in these cases In both types, but more so in the granular, there may develop coalescent or confluent shadows

3 An adequate period of observation has not elapsed to warrant any valid correlation between the clinical course of the disease and the magnitude of the pulmonary changes, nor is the final result known in those patients with clinical remission but persistent lung lesions Prognosis should be guarded in patients with the granular type of nodulation, especially when confluent shadows are superimposed It is also emphasized that roentgen pulmonary changes may exist without significant or any symptomatology

4 Roentgen differential diagnosis is discussed Many of the patients were at first suspected of having Boeck's sarcoid, in view of the roentgen and histological findings A diagnosis of silicosis was almost as frequently entertained It is possible that we are dealing with a serious type of pneumoconiosis not heretofore described The differential diagnosis of other pulmonary diseases is also considered

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SUMARIO

Características Radiológicas de las Neumopatías en los Obreros Expuestos a los Compuestos del Berilio

Este sumario compendia los datos clínicos que acompañaban las películas torácicas de 32 enfermos expuestos al polvo de los compuestos del berilio y en quienes se presentaron alteraciones pulmonares tardías Los síntomas más frecuentes fueron tos, disnea y pérdida de peso, en tanto que el hallazgo más notable de laboratorio consistió en policitemia Describense sucintamente las alteraciones patológicas observadas en varias autopsias, siendo la característica predominante en todas una reacción granulomatosa que infiltraba u obliteraba completamente el tejido intersticial

Los hallazgos roentgenológicos limítanse a los pulmones, caracterizándose por infiltración (1) bilateral, granular, difusa, distribuída por igual y/o (2) nodular No hay entidad patológica bien definida conocida que pueda producir la fina infiltración granular diseminada observada en estos casos En ambas formas, pero más en la granular, puede haber sombras coalescentes o confluentes En algunos casos, las películas seriadas han revelado agravación de las lesiones pulmonares y en otros, estabilidad sorprendente durante dos o tres años Rara vez desaparece completamente la infiltración pulmonar, siendo más frecuente un despejo pronunciado con persistencia de nodulación delicadísima

No ha transcurrido aun suficiente tiempo para justificar una correlación válida entre la evolución clínica y la magnitud de las alteraciones pulmonares, y tampoco se conoce el resultado final en los enfermos con remisiones clínicas pero con persistentes lesiones pulmonares El pro-

nóstico debe ser reservado en los enfermos que muestran nodulación de forma granular, máxime si se sobreponen sombras confluentes También hay que recalcar que pueden existir lesiones pulmonares reveladas por los rayos X sin mayor semiología

Discútese el diagnóstico diferencial con los rayos X En muchos de estos enfermos se sospechó al principio sarcoide de Boeck, a la luz de los hallazgos roentgenológicos e histológicos, y casi con la misma frecuencia se consideró el diagnóstico d silicosis Es posible que se trate de una neumoconiosis grave no descrita hasta ahora También se menciona el diagnóstico diferencial en relación con otras enfermedades

The Adult Silent Chest[1]

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IT HAS TAKEN twenty-seven years to make the medical profession routine-chest-examination or survey conscious After World War I, a program was proposed which included a chest film for every hospital admission The fate of that suggestion is well known Today, with the impetus received from the experience of the Army and Navy, plus the promotion by industry of chest roentgenography of all possible or present employees, the entire profession—not alone the radiologist—has been alerted to the value of such routine studies

At the present time, in industry, applicants for employment are screened to exclude those who might prove poor risks to the company The information gained is not to the benefit of the individual unless he is urged to diagnostic follow-up with competent treatment Likewise numerous instances of disease discovered in the draftee remain unappreciated by the victim Too often both the applicant for a job and the draftee are rejected without any knowledge of the reason and left to seek medical care "on their own" In this way a large amount of valuable information is lost to the individual and to the community From the public health aspect this is a distinct loss From the point of view of the individual two probabilities ensue either a definite pathological condition remains unidentified and untreated or a benign and insignificant finding becomes the basis of a psychosomatic case

It seems proper to differentiate between routine films and mass surveys Routine, as defined by Webster, is a detailed method of procedure regularly followed, a prescribed course of action A survey is a general comprehensive view Routine covers the run-of-the-mine patient Surveys are more selective, giving mass information on definite groups, localities, or conditions Routine films of patients admitted to hospitals, clinics, or doctors' offices show a higher statistical incidence of disease than mass surveys, for the obvious reason that some symptom, though not necessarily referable to the chest, has caused the individual to seek medical care

A chest film should become as much a part of the laboratory examination of every patient admitted to a hospital, clinic, and doctor's office, as the urinalysis, blood count, and blood Kahn test These three procedures, which became routine after World War I, have many times uncovered obscure etiology and been the clue to a brilliant diagnosis Similarly does x-ray uncover the unsuspected chest lesion and frequently give the lead to the correct diagnosis From 8 to 22 per cent of all general hospital or clinic patients show chest disease on routine admission films This percentage of positive findings is higher than with any of the other routine accepted procedures

We do not wish to imply that laboratory procedures take precedence over history and physical examination The two latter indicate the tentative or working diagnosis, to be confirmed by laboratory studies, which frequently must be repeated to make the diagnosis or to indicate therapeutic response or follow the course of the disease

Overholt and Wilson (1) stress the fact that surveys "discover but do not diagnose disease " They decry the danger of waiting for time to establish the seriousness of the lesion Too often when an unsuspected intrathoracic lesion is discovered, extensive search—*i e* , roentgenographic study in different positions and with special

[1] From the Department of Roentgenology Cook County Hospital, Chicago, Ill Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Dec 1–6, 1946

technics—is not resorted to in an effort to establish a definite diagnosis Time, an ally in many conditions, is more frequently a traitor in disease of the chest There are, for instance, apical lesions which resemble pneumonia, atelectasis, or pulmonary tuberculosis in which a differential diagnosis cannot be established without progress films There are pleural densities and pleural effusions which in themselves do not identify disease and which require the use of the Potter-Bucky diaphragm, instillation of lipiodol, and planigraphy to uncover the lesion All or part of these procedures, together with a complete history and physical findings, are necessary for a diagnosis With modern methods for radiographic examination of the chest, with which we are all familiar, augmented by examination of sputa and gastric washings for the detection of tubercle bacilli, bronchoscopy, and exploratory thoracotomy, which is now considered on a par with abdominal exploration, early diagnosis can be made of a suspicious or noncharacteristic lesion of the chest, and proper treatment can be instituted

Wangensteen has given four cardinal points setting forth what the clinician desires from an x-ray examination (*a*) information to confirm the diagnosis tentatively made on the basis of history and physical examination, (*b*) information to exclude certain diagnostic possibilities, (*c*) information which may lead to a diagnosis not previously thought of, (*d*) information as to the details of the pathologic anatomy present Attention to these cardinal points should lead to better co-operation between the clinician and radiologist Indeed, if radiologists would not only enlist in a campaign for routine chest x-rays but would join in the effort to exhaust their diagnostic possibilities in evaluation of the lesion, we would have more cases amenable to treatment instead of being faced so often by the terminal picture

The program proposed by the American Hospital Association, the United States Public Health Service, and the National Tuberculosis Association is directed toward the uncovering of tuberculous lesions There are sufficient statistical data from mass surveys to show that pulmonary tuberculosis is outnumbered by other intrathoracic conditions Hodges (2) has correctly stated that the detection of early lesions of pulmonary tuberculosis is not the sole purpose of routine chest examination, but also the discovery of unsuspected chest lesions of larger magnitude, namely bronchogenic carcinoma and mediastinal tumors Gould (3), in his analysis of 442,252 chest films, found non-tuberculous chest disease in 1 1 per cent—lesions of cardiovascular origin 0 602 per cent, bronchogenic carcinoma 0 002 per cent, and mediastinal masses 0 012 per cent Overholt and Wilson place the annual death toll from bronchogenic carcinoma in the United States at well over 15,000 and present statistical evidence that carcinoma of the lung represents over 10 per cent of all cases coming to autopsy, a finding confirmed by Jaffé (4) and Koletsky (5) Bloch and Tucker (6) call attention to the high incidence of mediastinal tumors, which are for the most part asymptomatic

Every hospital and clinic, regardless of size, is in a sense a teaching institution Besides the value to the patient and the community, the teaching value of routine chest examination should be stressed, and the importance of the history and physical findings to the radiologist who is to interpret the film should be pointed out to the intern and resident The student doctor must be warned against substituting x-ray for physical examination, rather he must develop his diagnostic ability by correlating physical and x-ray findings

Our small series of unselected cases discovered during routine barium studies and chest roentgenography at Cook County Hospital bears out the extensiveness of asymptomatic chest lesions Except for one unusual and interesting case (Case 2), which presented many differential diagnostic possibilities and went on to a spontaneous cure, we are presenting the clinical, radiological and pathological findings in a few representative cases

CASE 1 R B, a 50-year-old white female, was admitted to Cook County Hospital on Nov 3, 1943, with a history of sudden onset of severe pain in the left shoulder which radiated to the precordium The patient was in shock A diagnosis of acute coronary thrombosis was made, with pleural effusion to be considered X-ray examination confirmed the suspicion of effusion Serial thoracenteses over a period of two and one-half weeks yielded fluid which progressed from grossly hemorrhagic to clear No tumor cells were demonstrable, and cultures were negative Serial chest films failed to reveal the underlying lesion until three weeks after the onset, when much of the fluid was absorbed, and then only with the aid of Bucky technic There appeared to be a circumscribed density in the left base, the internal border was obliterated by the cardiac shadow, the base by the diaphragm, the external border by fluid in the costophrenic angle On lateral projection the tumor was clearly defined It was about the size of a small grapefruit, regular in contour, and posterior in position The lung fields were essentially negative Encapsulated fluid and tumor of the lung were considered Thoracentesis in this area yielded no fluid This absence of fluid, the firmness of the mass as encountered by the needle, and the lack of invasion of the lung led to the diagnosis of undifferentiated benign tumor of the lung

On Feb 18, 1944, three and one-half months after the onset of symptoms, an exploratory thoracotomy was done and a large extrapulmonary, well encapsulated mass located over the upper portion of the left lower pulmonary lobe on its posterior aspect was removed The tumor was firm in consistence and yellow-gray in color The pathological diagnosis was benign xanthofibroma

Postoperative x-ray and serial chest studies every six months to date reveal a slight fibrosis in the left base, moderate thickening of the interlobar pleura, and pleural diaphragmatic adhesions, findings residual from the surgery The patient is in good health at this time, three years after the onset of her illness

CASE 2 C R, a 53-year-old white male, was admitted to the Cook County Hospital on April 19, 1946, complaining of a cold of two weeks' duration There were no symptoms referable to the chest The temperature was 101 6° The clinical impression was a right lower lobar pneumonia Blood studies revealed hemoglobin 116 per cent, red blood corpuscles 5,960,000, white blood corpuscles 12,450, with 86 per cent polymorphonuclear leukocytes and 56 per cent immature forms No sputum examinations were made A chest film on April 23, 1946, four days after admission, revealed collapse of the base of the right lung, elevation of the right diaphragm to the eighth rib posteriorly, suggestive evidence of compression atelectasis at the dome and in the right costophrenic angle, parietal pleural thickening, and cardiac displacement to the left There was no evidence of fluid The right apex and upper lobe and the entire left lung appeared negative The left diaphragm was normal There was no evidence of free air under it The following pathologic possibilities in the order of their importance were considered symptomless eventration of the diaphragm, subdiaphragmatic abscess with massive gas collection, rupture of a hollow viscus, ruptured cyst of the lung with bronchial communications

Re-examination of the chest, April 26, 1946, revealed increased parietal pleural thickening, and a lateral projection showed a triangular area of atelectasis in the paravertebral border There was a small amount of free fluid present, demonstrable on both film and fluoroscopic examination A gastro intestinal study on the same day ruled out demonstrable evidence of a duodenal ulcer or bowel in the subdiaphragmatic area The diagnosis of subdiaphragmatic abscess was established two weeks after the discovery of the silent chest lesion Subsequent lipiodol studies showed no communication between the chest and the abdomen The only history that could be obtained from this co-operative patient concerned surgery for a hernia twenty-five years previously

On penicillin and sulfadiazine treatment, the temperature promptly subsided and, except for the first few days, the patient was ambulatory during his six weeks in the hospital Empirically a course of therapy for amebic abscess was given On May 5, two weeks after admission and after the therapy for amebic abscess, a watery diarrhea appeared, subsiding in a few days Stool examinations were negative Other than this, the patient remained asymptomatic Having refused surgical drainage, he was discharged May 29, 1946, with the subdiaphragmatic abscess still present Follow-up films on August 4, 1946, five weeks after discharge and eleven weeks after the initial x-ray examination, revealed complete resolution of the abscess

CASE 3 J J, a 45-year-old white male, was admitted to the Cook County Hospital on April 19, 1946, complaining of pain in the left knee and hip since the previous November, brought on by weight-bearing Two months previously he had what he described as a "cold," associated with a moderate non-productive cough and sensations of chilliness and fever The patient was treated by a private physician and recovered in one week Except for this episode, there were no further symptoms referable to the chest

Physical examination revealed a well developed, poorly nourished, chronically ill white male Temperature was 100 8° Dullness and absence of breath sounds were noted at the right lung

base posteriorly Repeated blood studies showed April 29, 1946, hemoglobin 50 per cent, red blood corpuscles 3,080,000, white blood corpuscles 19,500, with 86 polymorphonuclear leukocytes, May 1, 1946, hemoglobin 45 per cent, red blood corpuscles 2,680,000, white blood corpuscles 6,300, April 27, 1946, non-protein nitrogen 95 mg per cent, with creatinine 4, May 7, 1946, non-protein nitrogen 57 mg per cent, with creatinine 1 6, May 31, 1946, non-protein nitrogen 32 mg per cent

Admission chest examination revealed a ground-glass density in the right base emanating from the parabronchial border, leaving the periphery and a semblance of the costophrenic angle clear The density was sharply demarcated, its opacity increased as it approached the diaphragm, which was entirely obscured by it Some lung markings could be discerned through the ground-glass density There was moderate thickening of the right middle lobe interlobar fissure Lateral projection revealed a high posterior peaked fixation of the diaphragm, confirmed by fluoroscopic examination, and localized the lesion in the posterior portion of the base The remaining lung fields appeared negative The heart appeared normal *Impression* Unresolved lobar pneumonia

Eleven days following admission, anteroposterior and lateral films revealed clearing in the right base, small bronchiectatic dilatations, and persistent high right diaphragm fixation *Impression* Resolving right lobar pneumonia

On May 6 and 10, anteroposterior and lateral views suggested some increased cloudiness in the right base with a central area of increased density The diaphragm on lateral view presented a more concave appearance, and the question arose as to whether there was a superimposed partial atelectasis *Impression* Possible reactivation of the pneumonic process with partial atelectasis

On May 17, increased density was demonstrable in the right base, with three distinct small, circular cavity-like formations suggestive of multiple lung abscesses Because of the persistent pain in the left hip and a now palpable mass over the region of the left ilium, a scout film of the abdomen was made to include the pelvis This revealed a large destructive process in the left ilium with invasion of the wing of the left sacrum and the ischium These findings gave rise to the question of primary or metastatic carcinoma Was the infiltration in the lung associated with this lesion or was it entirely independent of it? We were misled by the clearing in the right base, in fact, a film of June 5, 1946, as compared with that of May 17, revealed clearing in spite of the evidence of a large cavity in the base which contained a fluid level An abscess of the lung was definitely established

On July 23, the chest revealed a well walled off abscessed cavity in the right base, posterior, with fluid level The left ilium showed no additional bone destruction On July 31, 1946, right decubitus, Bucky anteroposterior, and right lateral projections revealed the abscessed cavity in the right base, posterior, with fluid level changes On Aug 8, lipiodol was instilled in the right lower lobe bronchus, revealing an obstruction and irregularity in the main posterior bronchus leading to but not into the posterior lung abscess *Impression* Primary bronchogenic carcinoma of the right lung with abscess cavity, metastases to the left sacrum, ilium, and ischium

A moderate non-productive cough developed during the patient's stay in the hospital Severe pain continued in the left hip, controlled only by narcotics A mass, the size of an orange, hard and tender, became palpable over the left ilium The course was progressively downhill and death occurred four and one-half months after admission The postmortem findings were bronchogenic squamous-cell carcinoma of the right lower lobe with metastases in both kidneys, both ureters, the periaortic lymph nodes, and pericardium, abscess and bronchiectasis in the right lower lobe and chronic pneumonia of the right middle and upper lobes, chronic adhesive pleuritis of the right lung, chronic tracheobronchitis, moderate bilateral hydronephrosis and hydroureter, brown atrophy of the heart and liver and marked arteriosclerosis of the coronary arteries, metastases in sacrum, ilium, and ischium

CASE 4 C A , a 26-year-old colored female, was admitted to the Cook County Hospital on Aug 31, 1945, because of swelling in the neck, occasional gagging, and pain in the neck of ten months' duration There was no weight loss nor any sign of toxicity Physical examination revealed a mass in the region of the thyroid Blood studies showed hemoglobin 69 per cent, red blood corpuscles 3,660,000, white blood corpuscles 5,200 The basal metabolic rate ranged from plus 8 to minus 6 The clinical impression was a cystic thyroid A thyroidectomy was performed on Sept 15, 1945, and a large right-sided cystic friable thyroid was easily extracted The pathological report follows

The tumor weighs 22 gm The surface is nodular and the specimen contains an area of degeneration which is soft, pinkish gray, and hemorrhagic, containing areas of calcification Microscopic section shows large acini filled with thick cuboid and flat epithelium This node is surrounded by a thick fibrous capsule Outside this capsule is a small nodule, partly solid, partly small alveoli lined with low cuboidal epithelium *Diagnosis* Colloid nodose goiter and fetal adenoma

On June 7, 1946, about nine months after surgery, the patient was readmitted because of

recurrence of the tumor She was otherwise asymptomatic On June 14, 1946, surgery was performed and the tumor was removed The pathological report was as follows

The mass is soft, lobulated, light gray, and mottled by areas of purplish red On sectioning of the lobe of thyroid tissue there are single nodes up to 2 cm in diameter, light gray and moderately rich in colloid Microscopic section of the thyroid revealed one lobe to be composed of a nodose micro-macro-follicular goiter, the other lobe transformed into an adenocarcinoma with invasion of the capsule *Diagnosis* Adenocarcinoma of the thyroid gland

X-ray examination of the chest on June 18, 1946, showed bilateral nodular discrete metastatic lesions of varying size and density in the bases The apices and the upper lobes failed to reveal the slightest suspicion of invasion The lung markings appeared normal There was no evidence of enlarged hilar lymph nodes The bony thoracic cage appeared negative for metastatic invasion *Impression* Nodular metastases compatible with adenocarcinoma of the thyroid

CASE 5 M R , a colored female 46 years of age, was admitted to the Cook County Hospital April 9, 1946, with a history of metrorrhagia and menorrhagia Physical examination revealed wheezes throughout the chest and a few basal râles There were no cardiac findings A large firm nodular mass was palpable in the lower abdomen Blood studies revealed hemoglobin 73 per cent, red blood corpuscles 4,880,000, white blood cells 5,400 The differential count was normal Repeated sputum examinations were negative for tubercle bacilli A diagnosis of fibromyomata was made and surgery was advised

A film of the chest prior to the proposed operation, April 16, 1946, revealed the following findings coarse fibrotic infiltration in the right middle lobe and base with a coarse band-like fibrosis extending into the right upper lobe, minute compensatory bronchiectatic dilatations in the fibrotic area, right hilar fibrosis, in the left lung similar fibrotic infiltration to a lesser degree emanating from the hilus in the central zone with extension into the base and a large parabronchial lymph node in the central zone The cardiac-thoracic ratio, as far as could be determined through the density, appeared normal The findings were those of an unresolved pneumonia, probably atypical, with compensatory bronchiectasis Bilateral cervical ribs were present Re-examination of the chest, April 29, 1946, revealed some apparent decreased fine infiltration in the right middle lobe and base, with no appreciable change in the left base

The patient refused surgery and left the hospital April 30, 1946 At the request of the x-ray department, she returned on May 17, 1946, for a follow-up film At this time she complained of severe dyspnea of five days' duration X-ray examination showed a mottled infiltrative process in both lungs, more especially the left, emanating from the hili, spreading toward the periphery, invading the right middle lobe and base and the left base The coarse fibrotic strand in the right upper lobe was unchanged There were coarse infiltrative strands radiating from the left hilus into the left upper lobe Through the infiltration, nodular-like areas of increased density were seen, suggestive of a coalescence of the coarse infiltrative process not unlike a bronchopneumonia engrafted on an apparent reactivation and bilateral dissemination of an atypical pneumonia The cardiac shadow was too indefinite to be evaluated through the density Despite these findings, the patient refused to remain in the hospital She returned two weeks later, on May 30, 1946, complaining of increasing dyspnea and precordial pain and expired in a few hours

The postmortem findings were Cor pulmonale, slight fibroplastic deformity of the mitral valve, syphilitic mesarteritis and marked aneurysmal dilatation of the pulmonary artery, chronic pneumonia with bronchiectasis in the right lower lobe, pleural adhesions over the entire right lung, acute bronchopneumonia, hepar lobatum syphiliticum, chronic perisplenitis, chronic congestion of the liver, spleen, intestinal tract, and kidney, multiple fibromyomas of the uterus, chronic bilateral adnexitis, bleeding duodenal ulcer with severe terminal hemorrhage

SUMMARY AND CONCLUSIONS

This discussion on the "adult silent chest" will we hope add further impetus to the furthering of a routine chest examination for every patient admitted to a hospital, clinic, or doctor's office Survey statistics have proved that the method of choice is radiography

The case reports presented are in themselves sufficiently revealing to stress the necessity of early diagnosis and treatment of intrathoracic lesions, particularly those which threaten the patient's life

A program of this kind is valuable to the patient, the community, the student doctor, and the profession of medicine

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DISCUSSION

Fred J Hodges, M D (Ann Arbor, Mich) It is a great pleasure to be asked to discuss this paper As I listened to the presentation, I recalled that when the routine filming of the chests of all patients registering at our hospital was advocated some nine years ago, there was considerable reluctance among roentgenologists to accept the plan as a sound and practicable move Since that time, mass radiography has firmly established itself as a thoroughly worth while procedure

In 1934, at our hospital, we made a test of the utility of routine x ray surveying of all patients' chests during fourteen consecutive working days The exposures were non stereoscopic and were made on 14 × 17 inch transparent film These examinations of entering clinic and hospital patients were made without cost to the individuals We developed the films, put them away for three months, at the end of which time we examined them and then, by devious methods, looked back into the hospital records of the patients to see whether or not the examination might have been helpful in the matter of diagnosis

We learned, in time, that as a group we had made a gross error of omission once every day during that fourteen-day period We felt, and I think logically, that we could not afford an error of that extent if it could be avoided

Since that time, aided by the W K Kellogg Foundation, we have employed photofluorographic methods, beginning in 1941, and have completed a five year period during which we have attempted to get everybody who comes to our hospital or our clinic to stand in front of a fluoroscopic screen long enough to have a photofluorogram made We have not been able to get everybody, but we have achieved a fairly good percentage of the incoming group By no stretch of the imagination do we look upon those films as a full roentgen examination, and therein lies a worrisome thought that beleaguers a good many radiologists, who seem to think that some one is attempting to substitute a single miniature chest film for the full gamut of wares that radiology has to offer in chest diagnosis

We steadfastly believe that this is not the case Everybody connected with our department is urged to paste in his hat the motto that "admission chest films are for purely survey purposes" They are intended to separate the sheep from the goats, to indicate in which instances a real study of the chest is worth while As radiologists, we are very jealous of that position

Knowing that we have elaborate and specialized methods which we can use if and when they are indicated, we look upon the admission film purely as a screening device to decide in which instances more detailed x-ray examination will be helpful

Without taking too much of your time, let me say that the examples that have been given to you today are excellent illustrations, in my opinion, of the sort of thing that one may expect to encounter I think the title of the paper is well chosen—"The Silent Chest" This term describes those cases in which intrathoracic disease would be very apt to escape detection for a varying period of time unless roentgenology could offer a stop-gap method of prompt recognition In such situations admission films save needless days of hospitalization and unnecessary flounder ing with diagnostic methods With one simple device, one's attention can be drawn to signs of significant though silent disease It is a real gratification for those of us at one institution who have been using this procedure for some time to hear from the lips of another radiologist that the plan is proving satisfactory in his institution I recommend it to all of you

SUMARIO

El Pecho Silencioso del Adulto

Abógase por la ejecución de exámenes sistemáticos del tórax en todos los enfermos que llegan a hospitales, clínicas y consultorios de mèdicos, pues ese procedimiento debería ser tan de rigor como los uranálisis, la hematimetría y la reacción de Kahn Complementados, según esté indicado, con el examen bacteriológico del esputo y los lavados gástricos, la broncoscopía y la toracotomía exploradora, conducirían al diagnóstico temprano de muchas lesiones torácicas asintomáticas y permitirían la rápida iniciación de una terapéutica apropiada y a veces salvavidas

Preséntanse cinco casos descubiertos mientras se hacían estudios con bario y exámenes torácicos corrientes en el Hospital del Condado Cook (en Chicago, Ill), comprendiendo un xantofibroma extrapulmonar benigno, un carcinoma escamocelular broncógeno con extensas metástasis, lesiones ganglionares en las bases de los pulmones consideradas como metástasis de un adenocarcinoma del tiroides previamente extirpado, y lesiones torácicas difusas asociadas a sífilis en otros órganos El caso restante planteó muchos problemas de diagnóstico diferencial y evolucionó hasta una curación espontánea, siendo el diagnóstico final absceso subdiafragmático

Radiological Differentiation Between Pericardial Effusion and Cardiac Dilatation[1]

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IN SPITE OF OUR growing knowledge of the morbid anatomy and pathological physiology of the pericardium, the diagnosis of pericardial effusion has remained the perplexing problem that it has always been The multitude of clinical and roentgenologic signs suggested by various observers emphasizes the difficulty of differentiation without offering a reliable solution of the problem

In our experience two stages of pericardial effusion are not readily diagnosed the early fluid accumulation, which does not as yet display the classical symptoms, and the extreme filling of the pericardial sac, which must be differentiated from the heart enlargement due to rheumatic involvement, thyrotoxicosis, myxedema, and the various types of myocardial damage

In reference to the early roentgenologic recognition of pericardial effusion, certain statements are generally accepted (1) that smaller amounts of fluid, up to 250 or 300 c c , are usually not detectable fluoroscopically or on films, (2) that with the means available today it is not possible to differentiate between the heart shadow and pericardial fluid shadow on the basis of difference in density Even these fundamental rules will have to be revised, as with modern electronic devices, the limit of our perceptibility is constantly advanced and percussion and auscultation become the tools of another age

Textbooks on anatomy hold that the pericardial sac is a potential space lubricated by a small amount of fluid, it is further held that the pericardial fibers are normally not elastic and do not permit stretching If this were strictly true, the hypertensive heart, with considerable enlargement, would find its pulsation and dilatation inhibited by the unyielding pericardium, with consequent pericardial embarrassment This is not the case If we measure the diaphragmatic surface area of the pericardium, we find that it is considerably larger than the surface area of the heart which rests and moves about within it The pericardial space, at least at its base, is not a *potential* space but a *true* space, of variable width, and, like the mediastinum, the pericardium is frequently a lax structure Pericardial adhesions and calcifications are, therefore, as Sprague has pointed out, frequently unimportant findings

We might compare the heart-pericardium relationship to the fist enclosed by a kid glove The pericardium forms a rather loose-fitting glove, permitting the heart movement and growth, forming several folds, and becoming looser with age and wear A certain amount of stretching and relaxation of the parietal pericardium occurs during respiration due to the close fibrous tissue connection with the pleura. The phrenic nerve, which passes between the pleura and pericardium, does not always pierce the diaphragm, but is at times anchored to it, forming a tent-like elevation in deep inspiration Thus, the parietal pericardium during the inspiratory phase may be retracted into the medial margin of the lung field A deep blind recess is found behind the heart, running backwards between the left auricle and the posterior fibers of the pericardium, called the oblique sinus There are various other true spaces, one around the origin of the great vessels, where fluid may accumulate, as the potential capacity of the pericardial sac is normally greater than the mass of the enclosed organs

[1] From the Roentgenological Department, Mt Sinai Hospital, Chicago, Ill Accepted for publication in February 1947

It is evident that fluid, in so far as it is free to move, will accumulate in the most dependent part of the pericardial sac In the recumbent position, it will be found in the postero-inferior recess, in the upright position, in the antero-inferior recess, particularly if the body is slightly bent forward and inclined somewhat to the left On shifting the patient in the erect position from the left to the right inclination, the apical haziness due to the presence of fluid will sometimes disappear, making possible a differentiation from pleuritic involvement, atelectasis, or a fat deposit The lateral view in the recumbent position so frequently advocated has proved disappointing to us for the differentiation between heart enlargement and pericardial effusion More helpful has been the shift of the pericardial fluid into the superior recess, leading to marked shortening of the vascular pedicle, as demonstrated by Roesler

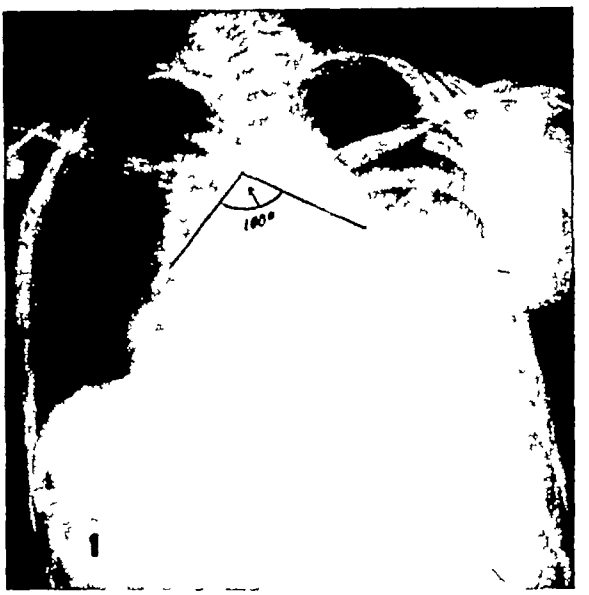
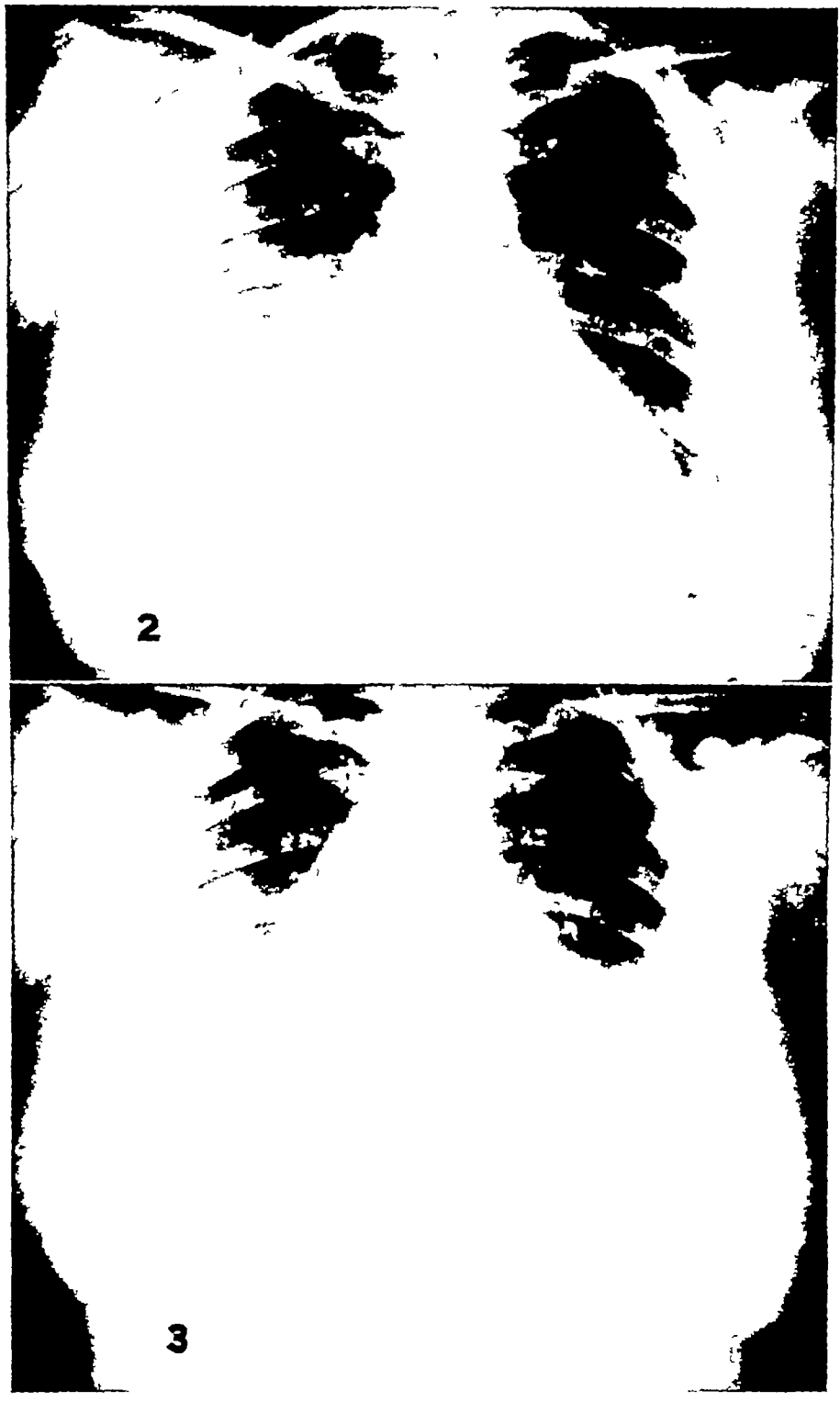


Fig 1 Case 1 Differentiation between cardiac dilatation and pericardial effusion difficult Clear visibility and widening of the angle of bifurcation speak for cardiac dilatation with left auricular enlargement At autopsy only 60 c c of fluid were found Old rheumatic valvular endocarditis with mitral stenosis and regurgitation

The shape of the heart has been considered characteristic by some observers Yet at least five different types have been described as pathognomonic of pericardial effusion the triangular, the trapezoid, the spherical, the water-bottle, and the onion type All these forms occur in pericardial effusion, and sometimes in succession in the same patient, according to the degree of filling, the mass of the heart immersed in the fluid and, an unknown factor, the degree of distensibility of the pericardial fibers in their pathological state The common denominator of these forms of heart configuration is a loss of the normal subdivisions Whenever it is possible to identify the points of division—namely, the intersection of the vascular and cardiac contours and of the cardiac and diaphragmatic contours on the right, the atrioventricular border at the left, and the farthest point at the left lower pole region—cardiac dilatation is indicated as against pericardial effusion

At this point it is necessary to introduce the *time factor* into the discussion of the problem The rapidity with which fluid accumulates in the pericardial sac is of critical importance If the pericardial effusion occurs rapidly, as in rheumatic infection with its attendant enlargement of the heart, relatively less fluid is necessary to produce a water-bottle or spherical shape, this would be still more evident in the case of the hypertensive heart In tuberculosis, conversely, with a slower accumulation of fluid, a small heart, and chronic infection of the pericardial fibers, the characteristic deformity would be a rather late development We might find a triangular heart becoming trapezoid and eventually, at the maximum of distention, assuming a configuration which is identical whatever its origin, the small pedicle set upon the large circular or ovoid shadow retracted at the points of fixation to the diaphragm It is this picture which permits a definite diagnosis of pericardial effusion, as it is almost characteristic The descriptive term "onion-shaped" appears well chosen However, prevalence of the transverse diameter over the longitudinal, so frequently found in such cases, is not entirely reliable as a sign of effusion, as it may also be present in dilatation of the



Figs 2 and 3 Case 2 Valsalva test used in differentiation Figure 2 was taken in deep inspiration with glottis pressure The heart becomes smaller due to influx inhibition, the subdivisions along the left heart border reappear the bifurcation is not obscured In mildly forced expiration (Fig 3) the heart 'falls apart," subdivisions flatten out pulsations increase. *Conclusion* The middle shadow is formed essentially by the dilated heart. *Clinical Diagnosis* Virus pneumonia with pleuritis, cardiac dilatation, no evidence of pericarditis

heart and has been described by Vaquez and Bordet as occurring in mitral insufficiency as well as in pericardial effusion

The time factor has been stressed by Freedman, who considers daily roentgen examination the most reliable method for the recognition of pericardial effusion and considerable change in the size of the heart shadow the best evidence of fluid accumulation. But while this is an important sign, it also will have to be revised in view of Wolff's report of five cases of acute rapid heart dilatation, associated with acute pericarditis complicating respiratory infection, with no fluid accumulation Barnes and Burchell also have observed many cases of pericarditis with rapid heart enlargement but without essential fluid accumulation This further complicates the roentgenological diagnosis In these cases of pericarditis with acute dilatation, recovery is complete within two to three weeks, but meantime the roentgenologist is faced with the problem of their differential diagnosis

In quest of further aid in the differentiation between pericardial effusion and dilatation of the heart, we investigated the value of the Valsalva test, apparently not previously applied to the problem The Valsalva test consists in deep inhalation and forced expiration against the closed glottis The heart during the test becomes increasingly smaller, probably due to influx inhibition and increased intrapulmonary pressure Immediately after restoration of the normal inspiration, the blood dammed up in the large veins rushes into the heart chambers, the original size is restored, and there is temporarily increased rate and amplitude of pulsation In the reverse process, known as Mueller's test, or better in its modification, Pong's test, which is nothing more than a forced expiration, the heart shadow spreads out on the elevated diaphragm, and the pulsations become freer, their amplitude increases, and the change in cardiac size is considerable In one instance quoted by Roesler, the change in volume was estimated to be 390 c c For the differentiation between

Fig 4. Case 3 The "onion" type of middle shadow with shortened pedicle and obscured bifurcation *X-ray and Clinical Diagnosis* Tuberculous pericarditis with maximal effusion

pericardial effusion and cardiac dilatation a combination of the two tests has proved valuable A pericardial sac filled with fluid, with inherent venous damming, will not, in spite of an increase or decrease in intrathoracic pressure, vary essentially in shape or size The middle shadow remains essentially the same, with only minor variations The dilated heart, on the other hand, responds strikingly to the test it straightens out and narrows on inspiration, it widens and "falls apart" in prolonged expiration When pulsations are present, they are more clearly seen, due to the increased amplitude at the time of the released venous reflux, as in uncontrolled respiration, conversely in pericardial effusion the pulsations do not show visible increase These tests can be done with the patient recumbent, and they do not impose too great a strain if not forcefully carried out and not too frequently repeated

Our search for more reliable roentgenologic signs of differentiation between pericardial effusion and dilatation of the heart revealed another helpful sign in the observation of the angle of bifurcation Normally the angle measures about 75

Figs 5 and 6 Case 4 Figure 5 shows the characteristic "onion" type of middle shadow suggestive of pericardial effusion No response to Valsalva test In Figure 6 (after tapping and air injection), though the right bronchus has cleared slightly, the left remains obscured by visible tumor *Autopsy* Large tumor mass of gelatinous character found over right ventricle and over base of heart Invasion of left pulmonary artery *Microscopic Diagnosis* Endothelioma of pericardium

degrees We found a slight degree of widening, to about 80 degrees, in exudative pericarditis, but greatly increased measurements—100 to 130 degrees—are usually due to direct pressure beneath the hilus by the enlarged left auricle, provided there are no large hilar lymph nodes present In experimental and clinical studies of pericardial effusion, a widening of the bifurcation is never mentioned, though it is a relatively common finding in mitral stenosis Not only is the bifurcation widened, but it is clearly visible in dilatation of the heart, while in pericardial effusion, even in early stages, in the recumbent position the bifurcation is obscured by the accumulated fluid in the recess of the pedicle *A rule can thus be established that a visible and widened angle of bronchial bifurcation is in favor of cardiac dilatation, while an obscured angle of bifurcation, not greatly increased, is in favor of pericardial effusion*

The observation of the esophagus with a contrast medium should not be entirely omitted, even if the findings are not always conclusive The esophagus is not displaced to the same degree in pericardial effusion as in cardiac dilatation In so far as the left auricle is prominent, the pressure area is located higher and is more deeply curved, in partial or general enlargement of the heart there are more lateral kinking and displacement than in the presence of pericardial effusion Brown and McCarthy have pointed out that in enlargement of the heart, the esophagus is invariably displaced backward and either to the left or right, while its position in the presence of pericardial effusion is almost unchanged and the heart shadow may be seen extending beyond the esophageal shadow Holtzman, while not claiming that such displacement never occurs in pericardial effusion, found it of less degree and less conspicuous than in cardiac dilatation

Diminution or absence of cardiac pulsation is an important diagnostic sign of pericardial effusion Kymography has been used by Stumpf to demonstrate such diminished pulsatory excursions, permitting differentiation from certain cases of thyrotoxic heart where the amplitude is increased But as Stumpf found, and as we have had occasion to observe, the transmitted pulsations of a pericardial effusion frequently present the impression of true pulsation This observation and the modi-

fication of the ventricular wave found in such cases suggested to us the possibility of creating artificially an interference wave which can be registered in the kymographic record Percussion to the left lower intercostal spaces at the time of recording, or shortly before, will modify the ventricular wave into an interference wave of fluid movement, as the distended pericardium lies directly beneath the chest wall Further observations are necessary, but the possibilities of kymographic differentiation are as yet not exhausted If it is possible to take two or more kymograms on different days after bed rest, the marginal pulsations will be shown to decrease further or remain imperceptible in pericardial effusion, they will increase in cardiac dilatation The differential diagnosis of pericardial diverticulum, pericardial cyst, and pericardial tumor is also facilitated by kymographic study

Among the auxiliary aids to the diagnosis of pericardial effusion, the absence of congestion of the lung (or, if it is present, its slight degree) is the most helpful This sign is found in the slowly accumulating type of effusion and is complementary to the clinical picture of relative absence of dyspnea The more acute types of filling lead rapidly to the picture of heart tamponade The atria and veins are compressed, the venous pressure rises, while the arterial pressure falls In such acute cases it is not unusual to find considerable congestion over the lungs

The multitude of clinical symptoms and physical findings elaborated since the seventeenth century give way to the diagnostic tap as the *ultima ratio* If roentgenologically a dilatation of the heart can be excluded, any of the various points in the left or right intercostal spaces or the epigastric and posterior site can be chosen for the tap In case of doubt, however, the epigastric (costoxiphoid) approach appears the most logical from the roentgenologic point of view, as it avoids the margins of the lung and the internal mammary vessels, as well as the main stem of the coronaries, and enters directly the

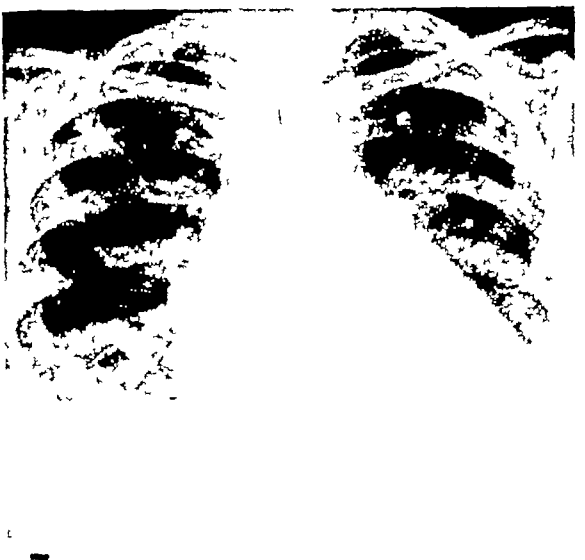


Fig 7 Case 5 This film illustrates the difficulties of the differentiation in a given case Tr>L, Valsalva test not applied Pericardial effusion suspected *Autopsy* No pericardial effusion, buttonhole stenosis of mitral valve relative insufficiency of tricuspid valve, hypertrophy and dilatation of right heart, rheumatic heart

lowest and widest part of the pericardial sac, the anterior diaphragmatic recess If pericardial tap were an entirely harmless procedure, no necessity would exist for Valsalva, kymographic, or roentgenologic studies Actually, injury to the coronary vessels, lung, and pleura, and a shock syndrome have been reported as complications of the procedure The dangers, however, should not be overrated

Pericardial effusion is not a rare occurrence Its frequent occurrence in children, following tonsillitis, scarlet fever, measles, scurvy, purpura, and even minor infections, has been recently stressed In adults the commonest causes are rheumatism (20 per cent) and tuberculosis (5 per cent) It is a complication, also, of chronic nephritis and has been found in amebic infections, and in alcoholics It sometimes stems from unknown origin, virus infections being suspected As a transudate, it is present in coronary occlusion, myxedema, and tumor

Tuberculosis of the pericardium usually occurs in patients over forty, while rheu-

matic pericarditis is seen at an earlier age, in children and young adults The tuberculous infection outside of the pericardium is usually minimal, and there are many cases on record of "primary pericardial tuberculosis" We have observed two such cases, in which no evidence of tuberculosis of the lungs could be found The number of pericarditis cases reported, either fibrinous or with fluid accumulation, following upon upper respiratory infection but without demonstrable cause, is increasing These reports coming from various army centers should make us pericardium conscious, for, as has been said, "One has to imagine a thing before one can find it"

CONCLUSIONS

Differentiation between cardiac dilatation and pericardial effusion, in spite of many clinical and roentgenologic signs, is not easy, especially as the two conditions may occur simultaneously and sometimes as a result of the same cause We have used to good advantage the Valsalva and Mueller tests in the roentgen differentiation The dilated heart shows more marked changes in size and shape than the heart enclosed in pericardial effusion or even the normal heart At the change over from the Valsalva to the Mueller test the weak pulsations of the dilated heart increase and become visible In the presence of pericardial effusion such pulsatory changes do not occur in equal measure

Observation of the angle of the bronchial bifurcation is further suggested as a diagnostic aid Its visibility is frequently obscured in pericardial effusion Visibility and widening to 100 to 130° favor a diagnosis of auricular enlargement or hilus tumor

Absence of lateral and posterior displacement of the esophagus or a rather shallow, wide-curved pressure zone along the whole length of the lower esophagus is in favor of pericardial effusion Lateral and posterior displacement and localized auricular impression are in favor of cardiac enlargement

Diminution or absence of cardiac pulsation is an important diagnostic sign of pericardial effusion, demonstrable by kymography The possibilities of this procedure are as yet not exhausted

Rapid change of the heart size at repeat examination is in favor of pericardial effusion, but is not a reliable sign There is no configuration of the heart entirely pathognomonic of pericardial fluid accumulation

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SUMARIO

Diferenciación Radiológica entre el Derrame Pericardíaco y la Dilatación Cardíaca

A pesar de muchos signos clínicos y radiológicos, la diferenciación entre la dilatación cardíaca y el derrame pericardíaco, no resulta fácil, máxime por coexistir ambos estados y ser a veces efecto de la misma causa En la diferenciación roentgenológica el A ha utilizado provechosamente las pruebas de Valsalva y Mueller Un corazón dilatado muestra alteraciones más marcadas en tamaño y forma que un corazón encerrado en un derrame pericardíaco y hasta que un corazón normal Al cambiar de la prueba de Valsalva a la de Mueller, las débiles pulsaciones del corazón dilatado aumentan y se vuelven visibles, mientras que no se observan por igual tales alteraciones pulsátiles cuando existe derrame pericardíaco

Como auxiliar diagnóstico puede además utilizarse la observación del ángulo de la bifurcación bronquial, cuya visibilidad se halla frecuentemente atenuada en el derrame pericardíaco Visibilidad y ensanche de la misma a 100–130° apoyan un diagnóstico de hipertrofia auricular o tumor del hilio

La falta de desplazamiento lateral y posterior del esófago o una zona de presión algo superficial y ampliamente curva a lo largo de toda la porción inferior del esófago militan en pro de derrame pericardíaco El desplazamiento lateral y posterior y una impresión auricular localizada apoyan la cardiomegalia cardíaca

La disminución o ausencia de pulsación cardíaca constituye un importante signo diagnóstico de derrame pericardíaco, que puede revelar la kimografía, cuyas posibilidades no se han agotado todavía

Una rápida alteración del tamaño del corazón al repetir el examen milita en pro de derrame pericardíaco, mas no constituye un signo fehaciente No existe configuración cardíaca que sea absolutamente patognomónica de un acúmulo de líquido pericardíaco

The Roentgen Treatment of Subacute Sinusitis in Children[1]

DONALD R LAING, M D

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THE PROBLEM OF subacute sinusitis in children deserves more attention than it has received, not only as to treatment, but also as to the education of our colleagues It is with more than a little amazement that I have heard the statement that a child is too young to have sinusitis Certainly if an infant is born with sinuses, as he is, he has the anatomical structures which make him a potential candidate for sinusitis

When a child has an upper respiratory infection that lasts for more than five or six days, the infection is certainly not an ordinary head cold The tonsils, the adenoids, or the sinuses may be infected and, to complicate matters, there may be an associated allergy It is not easy, and many times not possible, to arrive at a diagnosis One of the simplest tests, although not an unfailing one, is the nasal smear to determine the presence and predominance of pus cells or eosinophils The condition of the tonsils is fairly easy to evaluate at almost any age, but infection of the adenoids in the very young is difficult to determine A single film of the sinuses can be taken regardless of age, and this procedure, as is well known, is of considerable diagnostic value

We have treated over four thousand children for sinus infection in the past ten years Many of these had infected tonsils and adenoids Many had known allergies The ages ranged from one to thirteen, the majority of the patients being from four to seven years old It is the children in this age group—four to seven—who have the most trouble They are at a stage when their contacts with the outside world are increasing but as yet they have established little immunity This is also the age when many tonsillectomies are performed on the basis of repeated severe upper respiratory infections Yet in some cases, despite the absence of tonsils and adenoids, trouble still persists These children are often suffering primarily from sinus infection

Out of our four thousand cases, we have selected nine hundred which, as accurately as can be determined, are cases of subacute sinusitis Some of this group had tonsils and adenoids removed, others did not. The latter did not have marked infection in these areas The nasal smears of all were negative for evidence of allergy, and none had a definite history of allergy In all, sinus films showed varying degrees of infection in the maxillary and ethmoid sinuses The clinical history was usually that of a moderately severe upper respiratory infection, stuffy nose, low-grade fever, loss of appetite, and irritability Cough, often most marked at night, was quite common Rest, extra fluids, and nose drops of the shrinking type, sulfa or penicillin, would tend to alleviate the symptoms, but the sniffles and cough never entirely disappeared Recurrences of the more severe form of the infection occurred at intervals of six to eight weeks Many patients with severe infection had had a three-day course of sulfa, ranging from sulfanilamide to sulfamerizine Penicillin nose drops and penicillin spray were also used in some cases, but no penicillin was given orally or intramuscularly Except for some of the very young, none of these patients had blocked sinuses

We adhere generally to the dictum that a blocked sinus should not be treated by roentgen irradiation, but do not hold to this rule in very young children The reason for this is that younger children cannot have proper shrinking of the antral openings or washing of the antra

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America Chicago, Ill, Dec. 1–6, 1946

without being subjected to some type of anesthesia We have found that, by beginning the series of treatments with a small dose of x-rays, the desirable result is gained without any evidence of reaction, such as marked tenderness or pain in the region of the maxillary sinuses The beginning dose in the cases of blocked antral sinuses is usually 30 r

All of our cases were referred by pediatricians or by otolaryngologists Some patients had been sick for a month, others had had recurrences over periods of several months to a year

Subacute sinusitis in children is treated with difficulty by the clinician Many of the children will not submit to nasal packs, and all of them rebel at antral irrigations The usual symptomatic measures and chemotherapy do not produce the desired results It is not without reason that these patients have been referred to the radiologist The clinician has recognized the effectiveness of x-ray treatment in this disease He knows, too, that the ease of administration eliminates the possibility of psychic trauma to the child and to the mother

We have been fortunate in having the complete co-operation of our pediatricians and otolaryngologists Practically all of our sinus patients are sent to us with a written report of the essential history, or the case is discussed with the referring doctor by telephone We regard the knowledge thus obtained as highly important in the handling of the patient

In the average case of subacute sinus infection in children, the sinuses are treated anteroposteriorly, with a round 8- or 10-cm port, as the case requires The eyes and eyebrows are shielded by 2-mm lead "spectacle" shields, which are made in graduated sizes and are separated in the region of the bridge of the nose If cough is a predominant symptom, and it often is, the lung roots are treated anteroposteriorly through a round 8-cm port We believe that this area of secondary inflammation, which is due to some of the postnasal secretions sliding down the trachea, is an area of importance Our findings have caused us to believe strongly that the x-ray treatment of the lung roots serves to shorten the duration of the cough Certainly, in the cases where there are asthmatic manifestations, the rapid, favorable response is often spectacular

Treatment was also administered to the eustachian areas when there was an associated infection about the openings of the eustachian tubes causing some impairment of hearing or intermittent earache A large lead shield with a 7 × 7-cm port was used for these areas

Overlapping of the treatment areas was carefully avoided Not more than three ports were given x-ray treatment in any one series We felt it wise to keep the total dose down to a level which would be medically effective and below the level of criticism In practice, the majority of children were treated over the sinuses anteroposteriorly and over the lung roots anteroposteriorly

It is well to warn the mother about a possible reaction to the x-ray treatment About one-fourth of the children showed notable improvement after one treatment without any unfavorable reaction The remaining three-fourths showed varying degrees of reaction, ranging from mild to marked increase in the stuffiness of the nose and increased cough Elevation of temperature was recorded in 5 per cent of the cases, but the rise rarely amounted to more than one degree

The patient usually required very little extra care during the period of x-ray therapy Nose drops of all types were discontinued Increased congestion of the nose seldom required attention except for occasional application of hot compresses to the nasal area The child's activity was limited, but bed rest was rarely necessary The patient was to be kept warm at all times This meant heating the bedroom before bedtime and sleeping with the windows closed

In the younger children the following x-ray factors were used 130 kv p , 5 ma , filter 3 mm Al, h v l 4 1 mm Al, dis-

tance 30 cm In the older children the factors were 140 kv p , 5 ma , filter 0 25 mm Cu and 1 mm Al, h v l 0 42 mm Cu, distance 30 cm Three treatments were administered over a period of eight days, and a total of 240 r was given to each area

Out of the 900 children with subacute sinusitis 639, or 71 per cent, were cured after one series of x-ray treatments This group included those whose sinus films taken four to six weeks after treatment showed no evidence of infection and who were clinically free from evidence of sinus disease for at least one year following treatment

Fifteen per cent of the children showed moderate improvement In many of these patients the sinus films were negative or showed minimal evidence of infection, but the patients still had a mild case of "sniffles" and a slight night and morning cough Because of the favorable results in this group, we felt justified in attempting to gain complete cures With this idea in mind, we repeated the series of treatments after a six weeks' interval and found that 55 per cent of those receiving the second series of treatments were cured This gave complete recovery from sinus infection in 79 per cent of the total cases and favorable results in an additional 7 per cent

Fourteen per cent of the patients responded temporarily or not at all to x-ray therapy It is strongly suspected that the infection in this group is secondary to an undiagnosed allergy The possibility of parents with chronic sinusitis causing recurring infections in children must also receive serious consideration

The danger of x-ray therapy for sinusitis in children has been discussed many times We do not believe that there is any risk to the patient when the procedure is similar to the treatment received by our group The eyes and eyebrows are free from harm when properly shielded with lead We have never observed any latent skin damage and we have never had any reason to suspect changes in the pituitary gland

Subacute sinusitis in children is an annoying and troublesome disease It not only affects the patient, but is disturbing to the whole family There is a great deal of satisfaction in having a mother voluntarily telephone after the first x-ray treatment that they have had the first complete night's rest in several weeks The edge has been taken off the infection No major event has occurred, but the mother and family are grateful In any upper respiratory infection lasting longer than five or six days, involvement of the sinuses is to be strongly suspected The administration of x-ray therapy for subacute sinusitis in children is easy on the mother and child and is an extremely effective method of ridding the patient of the infection

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DISCUSSION

Clarence E Hufford, M D (Toledo, Ohio) I am very glad to have the opportunity to discuss this excellent paper I think that it is an outstanding achievement to have treated 4,000 cases of sinusitis in children in the last ten years I have had very little experience in treating sinusitis in children, but I have had some experience in treating children for hypertrophic lymphatic tissue causing eustachian tube block with accompanying deafness

A series of 56 cases which I reported last June showed 1-plus or 2-plus improvement in about the same percentage as achieved by Dr Laing in his cases In other words, the audiograms made by the otolaryngologists subsequent to treatment showed marked improvement or complete relief from deafness in over 73 per cent of the cases

As a prophylactic measure it seems to me that this is a worth-while procedure to consider Childhood deafness produced by obstructed eustachian tubes with hypertrophic lymphatic tissue may result in chronic middle ear changes which will mean deafness in adult life If we can prevent this, we are performing a real service I think it would be worth while if Dr Laing could give us some estimate of his impressions as to the effect on eustachian tube block of the type of treatment which he has been using for sinusitis in children

We have all heard a great deal about the use of radium in the treatment of these posterior hyper trophic lymphatic tissue growths I do not want in any way to detract from that method It will do a great deal of good But we as radiologists do not have to expose ourselves to another source of possible

injury from radiation We can produce as good or better results in these cases by x-rays without danger of injury to the patient or to ourselves Roentgen therapy in these cases is certainly a much less tedious procedure than the application of radium

Our own experience is with 200 kv , using a No 1 Thoraeus filter, administering 150 r measured in air to each side over a field 6 × 8 cm The central beam is directed through the middle ear and pharynx A total of 450 r is given over each side We have had to repeat with an additional 300 r bilaterally in a small percentage of cases In the series of 56 which I mentioned, there were 12 repeat cases Six of these showed good results with the additional treatment

As a prophylaxis against deafness in later years it seems to me that we may expect a great deal from the treatment that Dr Laing has been using for childhood sinusitis, which may be accompanied by deafness in a certain percentage of cases due to blocking of the eustachian tubes by hypertrophic lymphatic tissue

Henry J Ullmann, M D (Santa Barbara, Calif) I wish to congratulate Dr Laing on being able to report such a large group of patients which, of course, lends strong emphasis to the results and confirms the observations many of us have made on small groups for many years It is time that the profession should appreciate the value of x-ray therapy in childhood sinusitis

I would like to ask Dr Laing if he has noticed any difference in the results in those receiving the sulfonamides at the time of treatment, or just before treatment, and those treated by radiation alone The question has been raised whether the sulfonamides may not reduce the effect of radiation in certain infections I assume that all doses were measured in air I would appreciate knowing whether they were air doses or total skin doses

Anthony F Rossitto, M D (Wichita, Kan) I am indeed glad to hear this paper I had a similar paper read by title at the Radiological Society meeting last December [1] I thought I had a lot of cases to report, about 400, now increased to 600, which, of course, is a smaller series than Dr Laing's

I want to emphasize the fact that there is a great field in the treatment of these conditions and that it should be taken over entirely by radiologists In the conclusion to my paper, I stated that my good results might possibly have been due to the region in which I live—Wichita, Kan —and I expressed the hope that further reports could be made from different sections of the country It is interesting that this remarkable report comes from California

One point I should like to bring out especially, namely, that the pediatricians and otolaryngologists who are referring patients are thoroughly convinced of the value of the method and the excellence of the results My only difference in treatment is that I use 200 kv with 0 5 Cu plus 1 mm Al filtration, with a small field, giving the treatments at five- to ten-day intervals Three to five treatments suffice

Dr Laing's splendid report should encourage other radiologists to further this type of treatment

Question from the floor As I understand it, some of Dr Laing's cases were treated laterally If so, was the parotid gland protected in those cases?

Ivan W Woolley, M D (Portland, Ore) I also want to take this opportunity to congratulate Dr Laing upon such an excellent report His results compare with those that we have had in general experience

We have been interested in sinus therapy in children and adults for a great many years and I think that it is high time that all of us should be gaining more experience in this particular field The results with children are outstanding, but I agree with Dr Laing that the allergies should be avoided He is to be congratulated that he has the support of his pediatricians and otolaryngologists I think that will do a great deal to further this type of work

I feel it has been a privilege to listen to a report that has been so carefully prepared and covers such a large number of patients

Question from the floor I would like to know if Dr Laing has treated hypertrophic asthmatic cases, and with what results

Donald R Laing, M D *(closing)* I am sorry that I did not make myself clear as to the spacing of the doses We give three treatments, spaced over eight days, say, Monday-Thursday-Monday The doses are measured in air In the case of the blocked sinus the child is treated four times instead of three, 30 r being given on the first treatment When three treatments are given, the average dose per treatment is 80 r, making a total of 240 r

We do not have sulfa administered while we are giving therapy We don't like it, and we feel that we do not gain the desired results The pediatricians and otolaryngologists know that we do not like to treat patients who have been given sulfa within a period of about five to seven days before, so that all of our results are to be attributed to radiation alone

I can give Dr Hufford merely an estimate on the eustachian tube cases, for I have not reviewed all of them, but I believe we have roughly about 80 per cent cures

As to large doses, we do not believe these are necessary in infections, and the other reason we avoid them is to forestall criticism Too many people have heard about x-ray burns, about damage to the pituitary, and damage to the eyes, and it is often necessary to assure the mother that very small doses will be used Mothers know more about x-ray therapy these days than we would like to admit, at

[1] Published in Radiology 48 118–123, February 1947

least they discuss it over the back fence and they are moderately informed

We have sinusitis in California in spite of the sunshine We have pollens the year round, and allergies tend to set infection of the sinuses in motion by causing irritation of the mucous membrane of the sinuses and invasion secondarily As to the allergies, we do not really avoid them—among the 4,000 children treated there were many cases of allergy—but we treat them because everything else has been done and the doctor or the mother is desperate We don't give them any assurance of cure, for if the cause that has started the allergy is still active, one doesn't get very far Temporary relief is about all we have had in definitely allergic cases

The parotid gland is not protected I cannot recall at the present time having had any trouble with swelling or even moderate tenderness over that area Perhaps I have been fortunate I warn mothers about several things but I have not found it necessary to warn them about that

SUMARIO

Roentgenoterapia de la Sinusitis Subaguda en los Niños

De 900 niños con sinusitis subaguda tratada con los rayos X, 71 por ciento curaron con una sola serie de tratamiento, 15 por ciento revelaron mejoría moderada, y 14 por ciento sólo mejoría temporal o nula De los que revelaron mejoría moderada, 55 por ciento curaron al recibir la segunda serie

En la mayoría de los casos en niños, se tratan los senos anteroposteriormente por un portal redondo de 8 ó 10 cc , según exija el caso Los ojos y cejas se resguardan con escudos-"anteojos" de 2 mm de plomo Si la tos constituye un síntoma predominante, se tratan las raíces de los pulmones anteroposteriormente a través de un portal de entrada redondo de 8 cm El tratamiento también se administra a las zonas de la trompa de Eustaquio si existe una infección asociada en la proximidad de la abertura de la misma que afecta la audición u ocasiona otalgia intermitente En esas zonas se utiliza una pantalla grande con una vía de entrada de 7 × 7 cm

En los niños más pequeños utilizáronse los siguientes factores roentgenológicos 130 kv p , 5 ma , filtro 3 mm Al, capa de hemirr 4 1 mm Al, distancia 30 cm En los niños mayores, los factores fueron 140 kv p , 5 ma , filtro 0 25 mm Cu y 1 mm Al, capa de hemirr 0 42 mm Cu, distancia 30 cm Administráronse tres tratamientos durante un período de ocho días y un total de 240 r en cada zona

Hilar Densities Simulating Neoplasms[1]

CHARLES GOTTLIEB, M D [2], and HERBERT S SHARLIN, M D

IT IS A WELL established fact that, in order to reach a definite conclusion in diagnosing pulmonary lesions, there is certain essential information without which a radiological interpretation will be inadequate or impossible The value of the following types of information cannot be overemphasized (1) the history of the case, (2) facts derived from laboratory or surgical procedures, such as bronchoscopy and biopsy, (3) serial or follow-up studies Even though the radiologist is familiar with the use of such aids, he is sometimes tempted to follow the path of least resistance and make a snap diagnosis This paper will stress the value and importance of serial roentgenograms in establishing a final diagnosis

Because of the emphasis currently placed on the importance of early discovery of malignant neoplasms of the lung, we shall attempt to establish at this time an insight into the problem of differential diagnosis of pulmonary lesions only as they occur in the hilar region It should be noted that the term "hilar" density is an all inclusive one, referring not only to those densities in the region of the true hilus of the lung field, but also to those in its immediate surrounding vicinity The hilar density actually may have a more specific segmental locality, lateral and oblique views are necessary to localize the lesion more precisely It should be appreciated that more exact localization also can aid in the problem of differential diagnosis In this paper, however, we shall be concerned only with hilar densities as they are found in the single postero-anterior chest film

Though the literature is voluminous concerning the many radiographic criteria for the diagnosis of carcinoma of the lung in the early stages, we are faced with the fact that, as will be shown, none of these is pathognomonic Howes and Schenck, among others, point out the striking similarity of many cases to tuberculosis, lung abscess, central pneumonia, infarction, lymphoblastoma, neuroblastoma, and cysts In the final analysis, bronchoscopy is in most instances the decisive factor in making an early diagnosis

We shall consider lung neoplasms from an anatomical and pathological point of view only as they affect the hilar region The main type to be considered is the *hilar or infiltrative* tumor which may progress to (*a*) the *pneumonic* or (*b*) the *cavernous* form Kerley points out that these types are purely arbitrary, since one form may develop into another easily and rapidly In the roentgenogram of the chest we see only a momentary stage of any particular type of lesion The final pathologic findings depend upon the shape and size of the tumor, its position, its relation to the bronchus, and its manner of extension Atelectasis may be minimal or extensive, depending upon these factors A pneumonic process may or may not result, depending upon secondary bacterial invasion and constitutional factors Insufficient blood supply to the region will result in necrosis and cavitation

Although it is not within the scope of this paper to establish extensive criteria for the radiographic diagnosis of lung neoplasms, it will be shown by the following cases how relatively benign lesions may appear to fulfill familiar criteria on the basis of a single roentgenogram

CASE 1 A 54-year-old white male had a nonproductive cough of about two years' duration, which he attributed to excessive cigarette smoking He had lost no weight but had some chest pain on the left side The roentgenogram of the chest showed

[1] From the Department of Radiology New York City Hospital, New York Accepted for publication in April 1947

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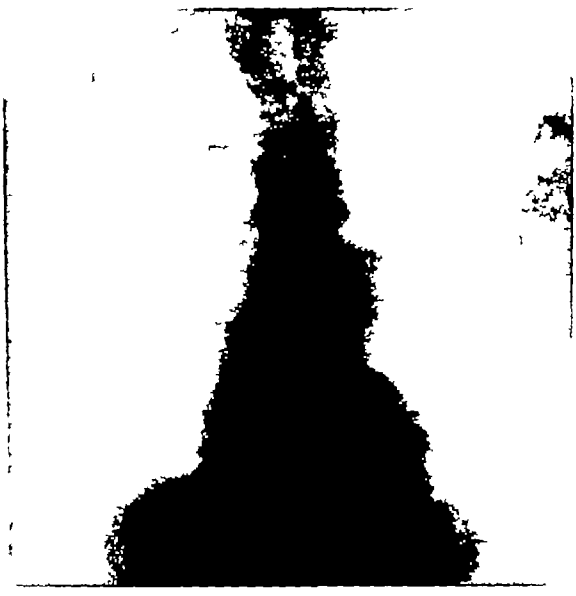

Fig 1 Case 1 Roentgenogram showing a density in the left hilar region Note the irregular contour of the shadow, as well as the linear strands radiating outward from it in fanwise fashion This film represents the "typical" appearance of bronchogenic carcinoma hilar type, in a fairly early stage *Bronchoscopy and biopsy report* Bronchogenic adenocarcinoma

an area of diminished illumination in the left hilar region (Fig 1) The density was irregular in contour, and strands radiated outward to the periphery Repeated examination many weeks later showed no change in the appearance of the lesion A diagnosis of bronchogenic carcinoma was made and confirmed by bronchoscopy The patient died of a massive pulmonary hemorrhage in about six months

Comment This case shows the typical appearance of a bronchogenic carcinoma of the hilar type, in a fairly early stage The large density in the hilus, irregular in contour, spreads out fanwise, with strands radiating outward to the periphery of the lung fields This shadow represents both the tumor growth in the bronchus and the accompanying atelectasis and possible lymph node involvement The extension of the neoplasm by lymphatic spread, in addition to accompanying inflammatory changes, may also contribute to the composite density in the hilar region

The subsequent cases will illustrate the fact that there is nothing pathognomonic in these hilar densities to establish a diagnosis of neoplasm on the first examination They will also show that follow-up studies and bronchoscopy are necessary to make a final diagnosis, since the same radiographic picture may be presented by inflammatory and neoplastic lesions

CASE 2 A 35-year-old Negro female with no complaints was given a routine physical examination as a hospital employee. A chest roentgenogram showed an area of diminished illumination in the right hilar region (Fig 2, A) The patient was hospitalized and her sputum was found positive for tubercle bacilli She was then transferred to a tuberculosis sanatorium, and a year later the chest roentgenogram showed complete clearing of the lung (Fig 2, B)

Final diagnosis Pulmonary tuberculosis

Comment This case illustrates the similarity in appearance of tuberculosis in the hilar region to a pulmonary neoplasm as seen in Case 1 In size, irregular contour, and fan-like appearance, the hilar density is not unlike that of the preceding case, and a final diagnosis could be made only by sputum examination

CASE 3 A 58-year-old white male was admitted because of throbbing occipital headaches of two months' duration Associated with the chief complaint were generalized weakness, vague pains in the chest, cough productive of scant sputum, and some exertional dyspnea The patient had a low-grade fever and did not appear acutely or chronically ill A routine chest roentgenogram showed a moderate-sized area of diminished illumination in the left hilar region, with linear strands radiating upward and outward A much smaller density was present in the right upper hilar region (Fig 3, A) Findings were suggestive of a neoplasm, and headaches were attributed to a possible cerebral metastasis Films of the skull showed no evidence of a malignant growth Supportive treatment was given The symptoms diminished considerably in severity in two weeks Repeated roentgenograms of the chest showed clearing of the densities after four weeks of hospitalization (Fig 3, B)

Final diagnosis Atypical pneumonia

Comment It should be pointed out that the majority of bronchogenic neoplasms are unilateral Farrell and others stress the importance of this fact in establishing a diagnosis Yet in a moderate percentage of cases the lesion may be bilateral, due to metastasis from the primary site in the hilus With this in mind, the lesion could easily be interpreted as a neoplasm of the hilar type

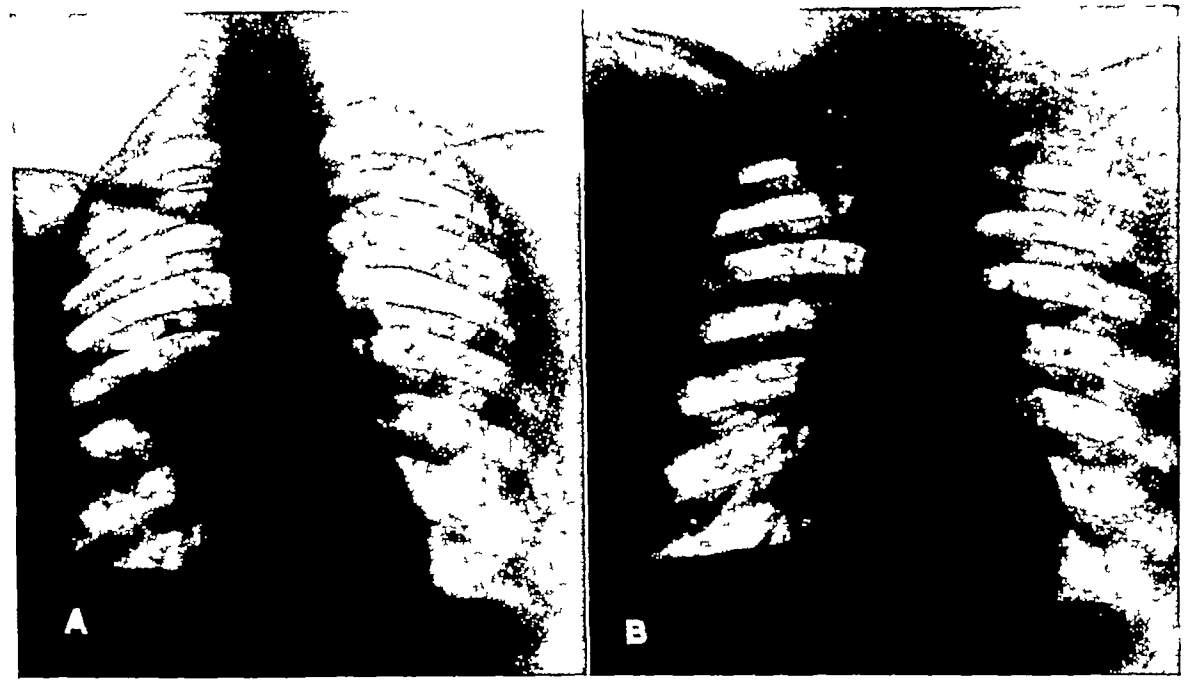

Fig 2 Case 2 A Roentgenogram showing a density in the right hilar region quite similar in appearance and characteristics to that in Figure 1
B Roentgenogram taken one year later, showing complete clearing of the density
Diagnosis Pulmonary tuberculosis

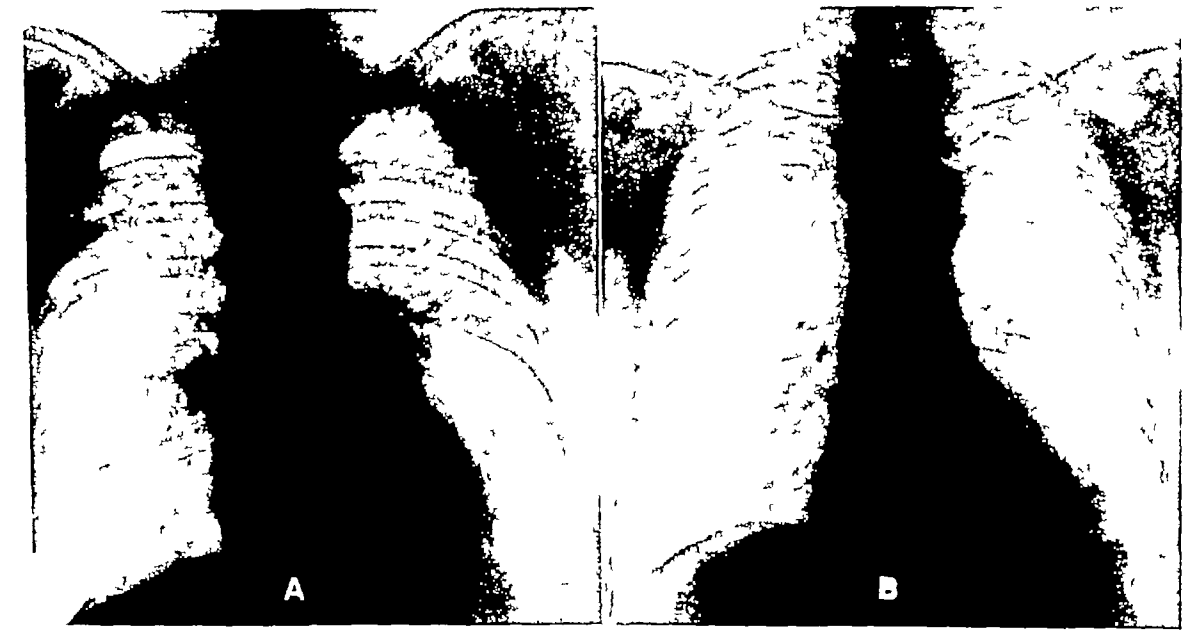

Fig 3 Case 3 A A density is present in the left hilar region, with strands radiating outward A smaller area of diminished illumination is present in the right upper lung field
B Roentgenogram taken four weeks later showing almost complete clearing of the densities
Diagnosis Atypical pneumonia

Follow-up studies were necessary in this case to establish a definite diagnosis of atypical pneumonia

CASE 4 A 52 year-old white female was admitted complaining of diarrhea of many months' duration Two days previously she had had chills and fever

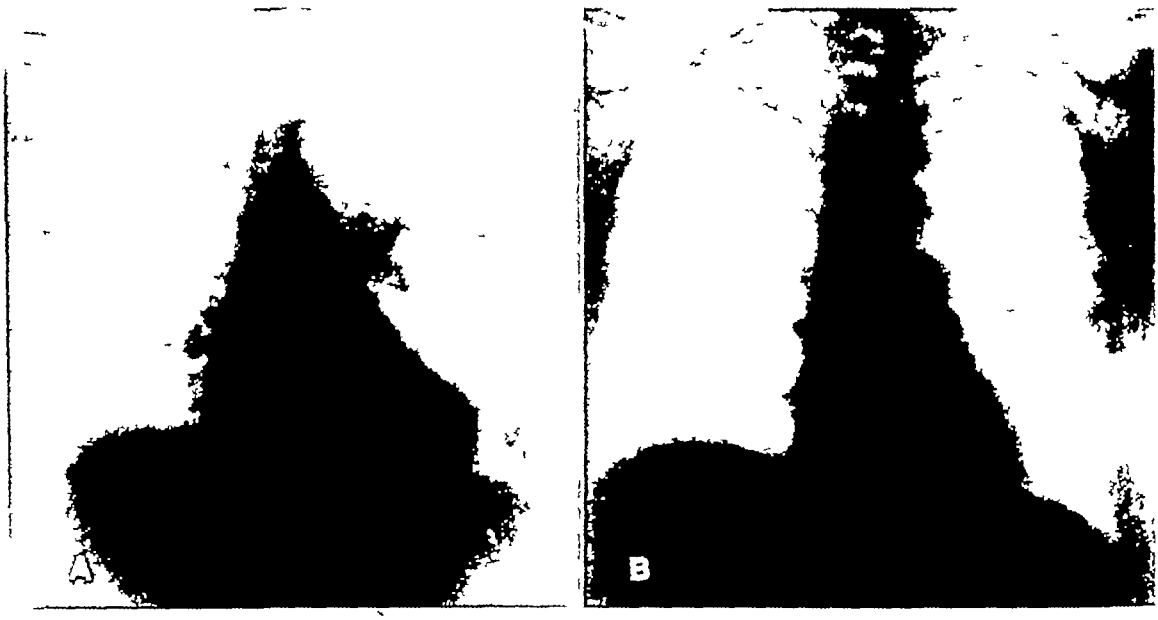

Fig 4 Case 4 A Roentgenogram showing a density in the left hilar region not unlike that in Figure 1 in appearance
B Follow-up film eleven days later, showing resolution of the density
Diagnosis Central pneumonia

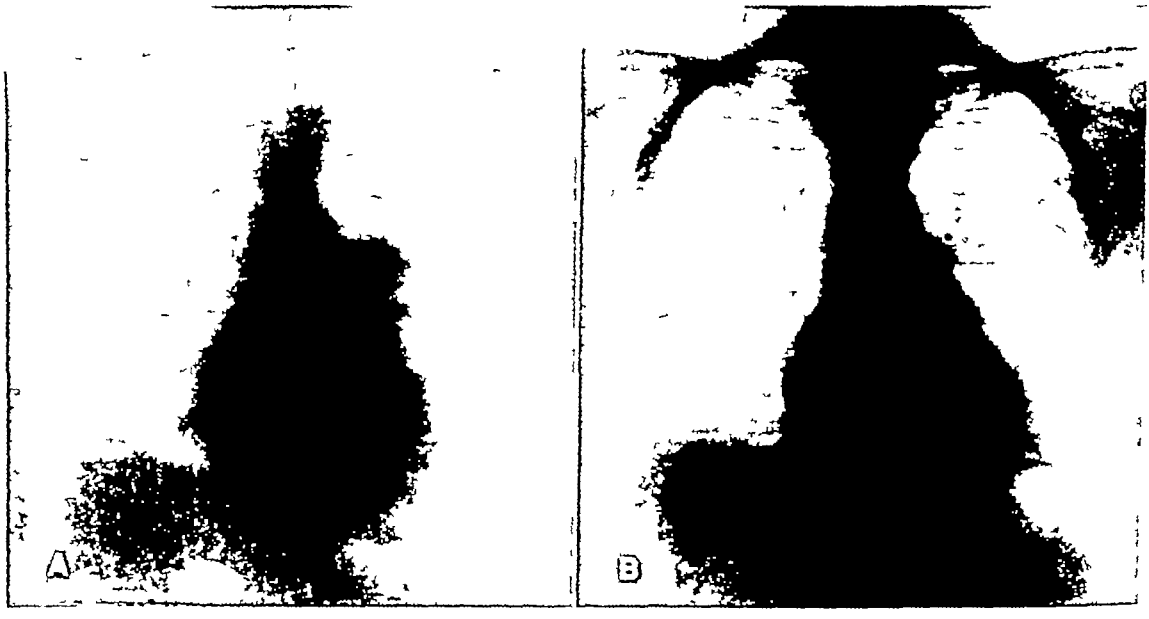

Fig 5 Case 5 A Admission film showing a triangular density in the left hilar region The appearance is similar to Figure 1
B Follow-up film eight days later showing complete clearing of the density
Diagnosis Loeffler s syndrome, eosinophilic pneumonia

There had been a non-productive cough for years The patient was acutely ill but responded well to chemotherapy A roentgenogram of the chest showed a triangular patch of diminished illumination in the left hilar region (Fig 4 A) Another film taken eleven days later showed complete resolution of the pneumonic consolidation (Fig 4, B)

Final diagnosis Central pneumonia

CASE 5 A 44-year-old white female was admitted complaining of pain in the left side of the chest, slightly productive cough, sweating, and weakness of four weeks' duration The past history was non contributory except for a definite allergic background, including hay fever and food allergy The

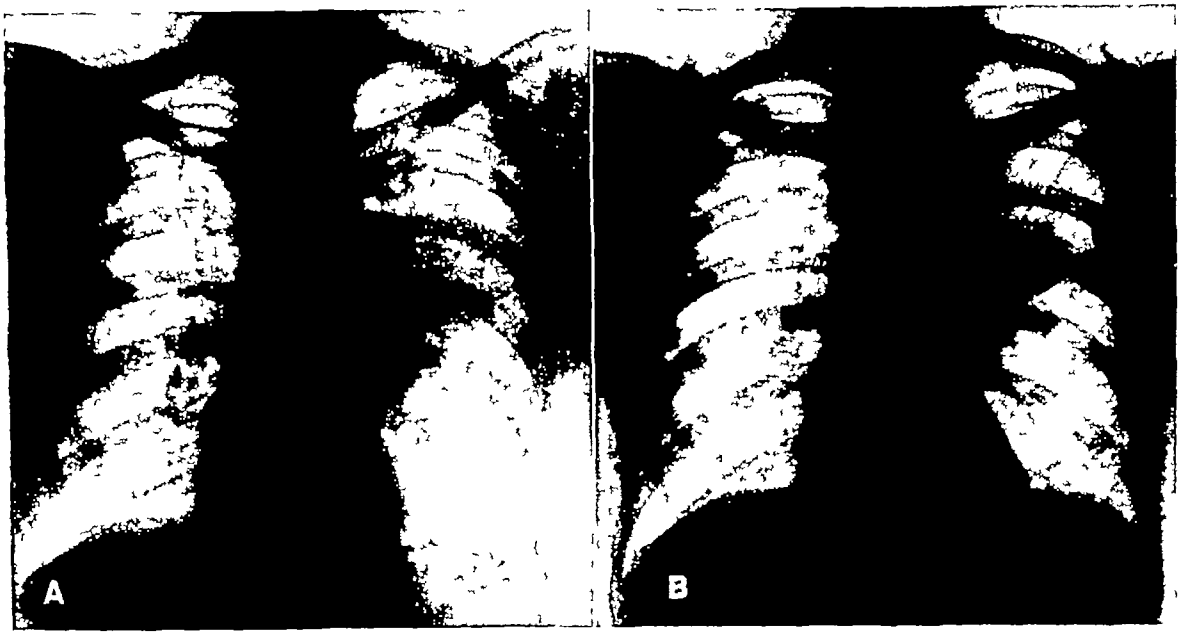

Fig 6 Case 6 A Roentgenogram showing a hilar density in the left lung field Fluid levels are present in the second and fourth anterior interspaces The cavitary form of bronchogenic carcinoma may present a similar appearance

B Film taken three weeks later, showing considerable clearing of the density, as well as disappearance of the fluid levels

Diagnosis Lung abscess

patient appeared acutely ill, her temperature was 102°, returning to normal by lysis in seven days without chemotherapy On admission, the white blood count was 13,800, with 63 per cent polymorphonuclear cells, 20 per cent lymphocytes, 8 per cent monocytes, and 9 per cent eosinophils Daily blood counts showed a marked rise of the eosinophil count to 30 per cent, gradually falling to 9 per cent two weeks after admission A roentgenogram of the chest showed a triangular patch of diminished illumination in the left hilar region, irregular in contour, with strands radiating outward (Fig 5, A) A follow-up film eight days later showed complete clearing of the density (Fig 5, B)

Final diagnosis Loeffler's syndrome, eosinophilic pneumonia

Comment Although the etiologic agents were different, Cases 4 and 5 are similar in that they both represent densities in the hilar region whose appearance may be confused with the hilar type of pulmonary neoplasm, if interpreted from a radiological view *per se* History and follow-up studies were essential factors in the final diagnosis These densities are not unlike those found in malignant neoplasms of the hilar infiltrating type, which eventually encroach upon a bronchus, causing atelectasis and pneumonic consolidation of varying degree Hennell and Sussman express the same opinion in discussing the differential diagnosis of eosinophilic pneumonia, the hilar type of tuberculosis, and suppurative bronchopneumonia

CASE 6 A 45-year-old white male was admitted for malaise and cough of three months' duration About five months previously the patient had several teeth extracted under general anesthesia and contracted "pneumonia," which was slow in responding to treatment He had lost 15 pounds in the three months prior to admission Cough was moderately productive, occasionally yielding blood streaked material Pain in the left side of the chest accompanied paroxysms of coughing Sputum was occasionally foul Temperature on admission was 102°, and the patient appeared chronically ill A roentgenogram of the chest showed an area of diminished illumination in the left hilum, extending outward in fanwise fashion Within this area two fluid levels were noted in the second and fourth interspaces (Fig 6, A)

The patient was treated conservatively by postural drainage, and improved rapidly A repeat roentgenogram of the chest three weeks after initial examination showed considerable clearing of the density, with disappearance of fluid levels (Fig 6, B)

Final diagnosis Lung abscess

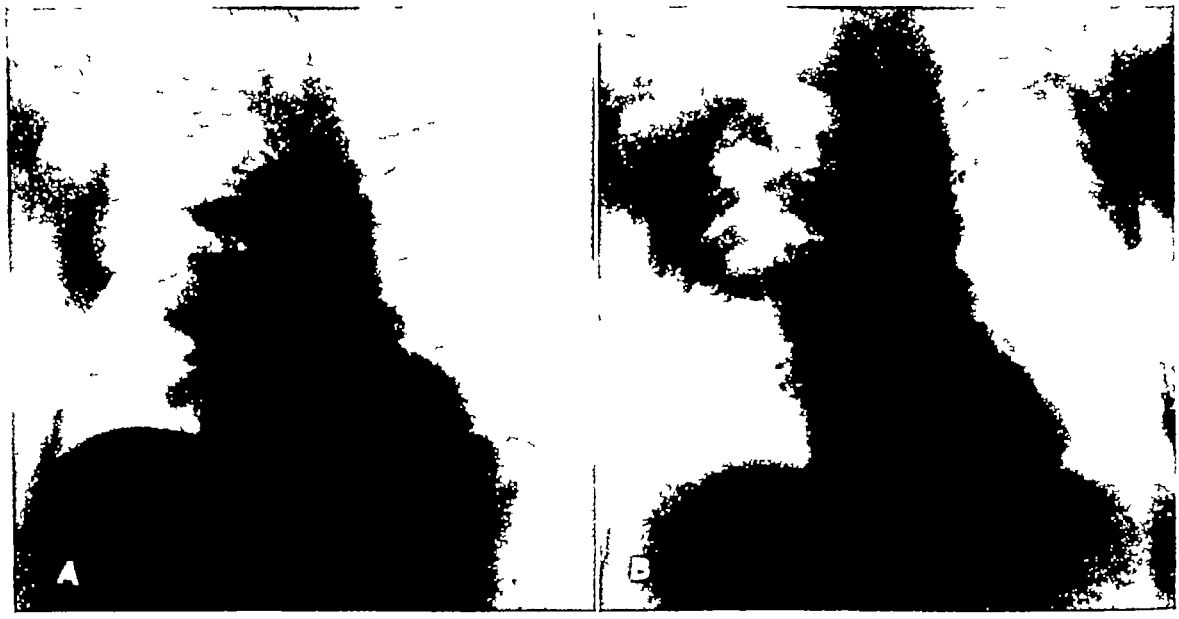

Fig 7 Case 7 A Roentgenogram showing a hilar density in the right lung field The contour is irregular and linear strands radiate outward to the periphery as in Figure 1
B Follow-up film two weeks later, showing a fluid level in the second anterior interspace The appearance resembles that of bronchogenic carcinoma progressing into the cavitary form
Diagnosis Lung abscess

CASE 7 A 51-year-old white male was admitted complaining of a cough of ten weeks' duration, and occasional night sweats and fever Cough was productive of a moderate amount of non purulent sputum, occasionally blood-streaked The patient experienced constant pain in the right side of the chest, and had lost 20 pounds in the past ten weeks A roentgenogram of the chest showed an area of diminished illumination in the right hilar region, with strands radiating outward to the periphery (Fig 7, A) Re-examination two weeks later showed a fluid level within this density, which was unchanged in size and appearance. Repeated sputum examination was negative for tubercle bacilli The abscess was drained by bronchoscopy, and the patient improved rapidly
Final diagnosis Lung abscess

Comment Cases 6 and 7 present no great diagnostic difficulty, providing attention be given to the follow-up studies In neither case can the appearance of the density be differentiated from a cavernous type of malignant neoplasm In Case 7, further difficulty arises in the fact that the fluid level did not make its appearance until two weeks after the initial examination Both patients were chronically ill, had hemoptysis, weight loss, and chest pains The similarity of these histories to those of patients with lung neoplasms is striking A definite diagnosis was reached only by withholding final opinion until follow-up studies were made

Kirklin and Paterson have observed that in a large series of cases of bronchogenic carcinoma, those most frequently misdiagnosed were of the cavernous type, which were thought to be lung abscesses Howes and Schenck also point out the likeness between a lung abscess and the cavernous type of bronchogenic carcinoma Other investigators, Holman and Pierson, dealing with differential diagnosis, state that carcinoma of the lung often presents a clinical picture resembling pulmonary suppuration so closely that an exact diagnosis is possible only by bronchoscopy or exploration They are of the opinion that any long unresolved pneumonia or persistent suppuration that does not yield to the usual therapeutic measures should be considered a neoplasm unless proved otherwise

CASE 8 A 36-year-old white male gave a history of chronic cough and loss of weight of 30 pounds in the preceding year Cough was slightly productive,

cinoma are discussed Roentgenograms in such cases may pattern themselves very closely after the early stage of the hilar type of bronchogenic carcinoma, including as well progression into cavernous and pneumonic types

The radiologist, when interpreting hilar densities of this type, should not make an etiologic diagnosis on the basis of a single roentgenogram, since there are no criteria pathognomonic of the neoplastic lesion described in this paper

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SUMARIO

Sombras Hiliares que Simulan Neoplasias

Preséntanse casos de tuberculosis pulmonar, neumonía atípica, neumonía central, síndrome de Loffler (neumonía eosinófila), absceso pulmonar y resolución neumónica tardía, para indicar que el aspecto observado en la película torácica posteroanterior puede semejar muy de cerca el del carcinoma broncógeno temprano de tipo hiliar, comprendiendo también la evolución a los tipos cavernoso y neumónico En los casos comunicados, las películas subsiguientes y las pruebas de laboratorio ayudaron diagnóstico correcto

Dado que no existen patognomónicas para piente del hilio, el utilizar todos los a su alcance, incl copía y radiografí nóstico etiológico radiografía pos cir bastante fác erróneo

Roentgenologic Aspect of Certain Lesions of Bone Neurotrophic or Infectious?[1]

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"NEUROTROPHIC changes" in bones, especially of the feet, have been reported by several authors Sante has described the effects of these trophic disturbances of nerves as being most pronounced in the metacarpal and metatarsal bones and the phalanges of the hands and feet The distal ends of the bones become smaller in caliber and the terminal phalanges are atrophied to fine points This process of destruction may continue until the heads of the metacarpal and metatarsal bones are completely separated from the distal ends of the shafts Sante made the further observation that such pronounced osseous lesions are usually accompanied by punched-out trophic ulcers of the soft parts

Shanks, Kerley, and Twining stated that "in certain conditions such as tabes, syringomyelia and leprosy marked osteolytic changes are often seen in the small bones of the hands and feet The most typical appearance is a short and pointed phalanx from partial absorption which has commenced at the distal end of the bone " According to these writers, the condition may be complicated by secondary infection from a perforating ulcer, usually under a metatarsal head

Holmes and Ruggles mentioned a case of diabetes without obvious changes of nerves in which there was shrinkage of the terminal phalanges and erosion of the articular ends of the metatarsal bones

The term "neurotrophic" is used to describe changes in the soft tissue and bone due presumably to some disturbance in the nerve supply to that part That some type of "neurotrophic" disturbance exists which does lead to soft-tissue changes and which may act to produce trophic ulcers and other lesions of the soft tissues seems to be beyond doubt In the past, certain lesions of the bone, especially in the feet, have also been ascribed to "neurotrophic" disturbances These are characterized, as pointed out by Sante, by progressive absorption of the heads of the metatarsal bones and phalanges, decrease of the caliber of these bones, and "pencil-point" deformities of the metatarsals The purpose of this paper is to investigate the validity of the assumption that these changes are actually the result of "neurotrophic disturbance "

TABLE I AGE DISTRIBUTION OF "NEUROTROPHIC" LESIONS OF BONE

Age (years)	*Cases*
10–20	5
21–30	4
31–40	12
41–50	16
51–60	14
61–	10
TOTAL	61

Sixty-one cases, selected because the roentgenograms of the feet showed one or more of the previously defined criteria for the roentgenologic diagnosis of "neurotrophic changes" in bone, have been reviewed The lesions occurred most frequently among patients from forty-one to fifty years of age, though all ages beyond the first decade are represented (Table I)

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill , Dec 1–6 1946

FIG 1 Seventeen-year old girl with spina bifida and myelodysplasia foot trouble since birth She had had recurrent infection with swelling and inflammation of the soft tissues and the development of ulcers which had been present for three years before this roentgenogram was made Some of the phalanges are completely resorbed

Thirty-five of the 61 patients were men and 26 were women

Of the 61 patients, only 15 were found to have diseases involving the nervous system (Table II), and in each one of this smaller

TABLE II DISEASES INVOLVING NERVOUS SYSTEM IN CASES OF "NEUROTROPHIC" LESIONS OF BONE

Disease	*Cases*
Spina bifida with myelodysplasia	3
Tumor of lumbar segment of spinal column	2
Injury of sciatic nerve	2
Taboparesis	3
Myelitis	1
Spina bifida without myelodysplasia	3
Poliomyelitis	1
TOTAL	15

group, the "neurotrophic" bone changes were associated with an acute or chronic trophic ulcer of the foot (Figs 1, 2, and 3) The length of time that these ulcers had been present is of interest 5 for less than one year, 5 for one to ten years, 4 from ten to twenty years One patient had had a chronic trophic ulcer for more than twenty years

In many of the remaining 46 cases (Table III) there was some systemic disease, circulatory disorders and diabetes being most frequent (Fig 4) There was,

TABLE III CASES OF "NEUROTROPHIC" LESIONS OF BONE IN WHICH NO DISEASE INVOLVING NERVOUS SYSTEM WAS PRESENT

Condition	*Cases*
Diabetes	19
Thrombo angiitis obliterans (Buerger's disease)	3
Diabetes and thrombo angiitis	2
Gastric ulcer	1
Arteriosclerosis	3
Syphilis and thrombo angiitis	1
No systemic disease noted	17
TOTAL	46

FIG 2 Forty-nine year old man Myelitis had developed at the level of the eleventh and twelfth thoracic segments following injury to the spinal cord There was a history of recurrent ulcers on the foot for thirteen years The roentgenogram demonstrates extensive changes involving bone

Fig 3 Twenty-five-year old woman with spina bifida and a possible club foot The inflammatory process began in an infected callus and progressed There had been an ulcer on the foot for six years prior to the time that this roentgenogram was taken

however, a group of 17 cases without demonstrable systemic disease (Figs 5, 6, and 7) The question arises why, in this comparatively large group, without circulatory, systemic, or nervous disease, so-called neurotrophic changes in bone should occur

Reviewing this series of 61 cases, it appears that the chief factor in producing the changes in bone was not a disturbance of the nerve supply, since diseases of the nervous system occurred in less than a quarter of the group Circulatory disorders were present in an even smaller percentage Is there, then, any common factor to which the bone lesions may be attributable?

An acute or chronic inflammatory process of the soft tissues in the region of the involved bone was found to be present in all of the 61 cases (Table IV), suggesting the possibility that this may be the direct cause of the bone changes, independent of

TABLE IV INFLAMMATORY PROCESSES IN CASES OF "NEUROTROPHIC" LESIONS OF BONE

Type of Inflammatory Process	*Cases*
Ulcer, recurrent ulcer, or sinus tract	55
Chronic inflammatory process, no definite ulcer	6
TOTAL	61

Fig 4 Sixty-three-year old man who had had mild diabetes for several years The infection began in a callus and gradually extended At the time that this roentgenogram was made a chronic ulcer of the foot had been present for five years The roentgenogram shows extensive resorption of bone

any associated circulatory, systemic, or nervous disorder In those cases in which lesions of the nervous system are present, it is conceivable that the infection in the soft tissue may be the result of some neurotrophic disturbance There seems to be no evidence, however, indicating that neurotrophic changes are the direct cause of the bone lesions The latter are the result rather of a chronic osteomyelitis secondary to infection of contiguous soft

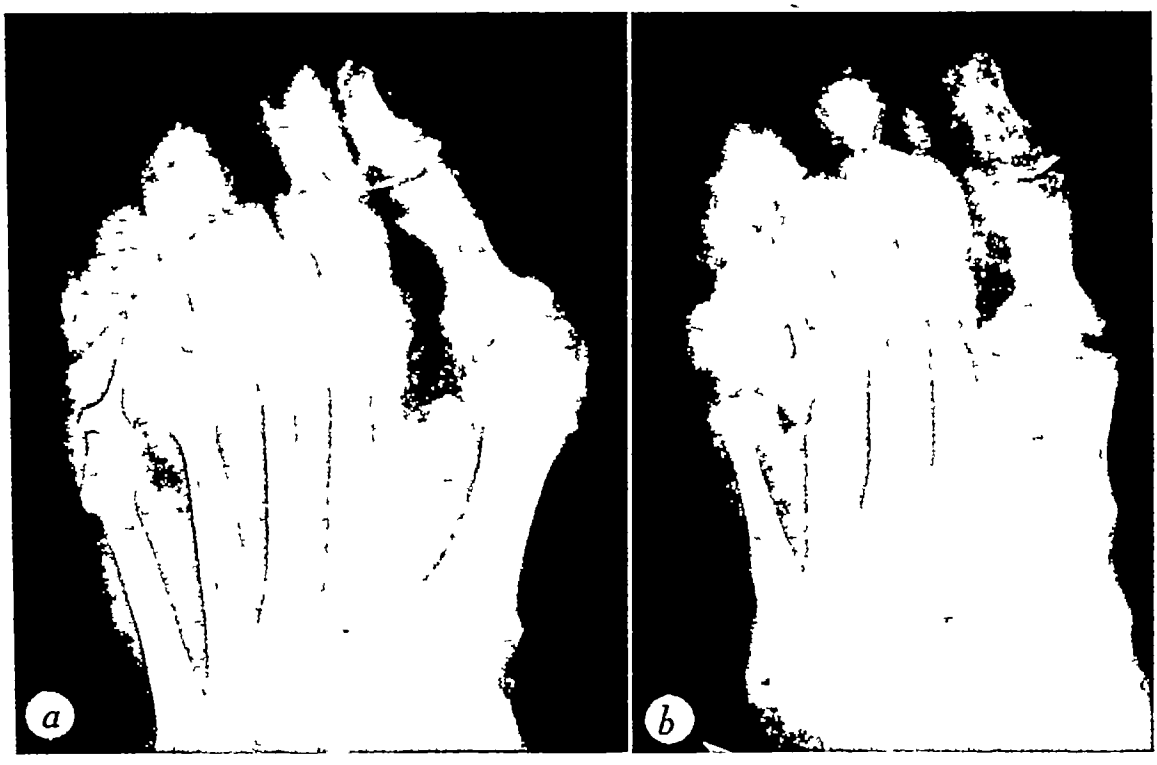

Fig 5 *a* Forty-five-year-old woman with infected calluses and hallux valgus Pencil-point deformity of the fifth metatarsal bone and first phalanx of the fifth toe The hallux valgus was corrected and a Hoffman operation was done in 1940

b Roentgenogram made four years later The infection persisted and there has been further resorption of the metatarsal bone and phalanx of the fifth toe

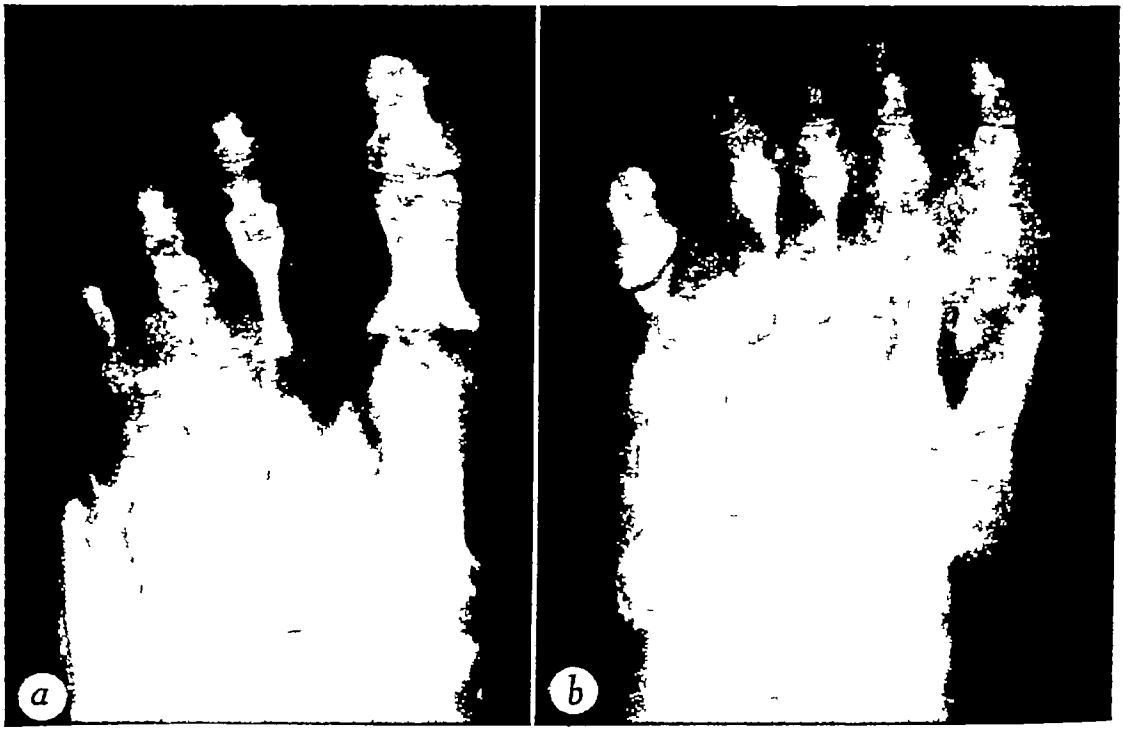

Fig 6 *a* Twenty four-year-old woman who had severely burned her feet Infection developed and had been present for seven years before this roentgenogram was made Numerous sinus tracts were present Roentgenogram of the left foot with extensive changes involving bone

b Roentgenogram of the right foot showing similar changes

tissue We do not propose to attempt to explain what changes may take place in the nerves or circulatory system supplying the bone, but merely to point out the coexistence of inflammation of soft tissue and associated changes in the contiguous bone

Since it was found that infection was present in all of these cases, the nature of the infection and the possible causes were next investigated, with the results set forth in Table V

TABLE V NATURE OF INFECTION IN CASES OF "NEUROTROPHIC" LESIONS OF BONE

Nature of Infection	*Cases*
Trophic ulcers due to lesions of the nervous system	15
Infected calluses	10
Injury with infection	8
Ulcers or infection associated with diabetes or circulatory disease	28
TOTAL	61

If the bone changes are indeed those of a chronic osteomyelitis secondary to infection from surrounding inflammation in the soft tissues, the soft-tissue infection must be shown to precede the osseous lesions This proved to be extremely difficult, since roentgenograms of the feet were not, as a rule, made at the time of onset of the infection of the soft tissue There were, however, a few cases in which such roentgenograms were available, revealing no changes in the bones, while subsequent roentgenograms showed gradual development of the so-called neurotrophic lesions

In certain cases of rheumatoid arthritis and psoriasis, especially those of long standing and with extensive involvement, changes occur in the bones of the feet very similar to those which have been designated as neurotrophic These diseases may certainly be considered as chronic infections of the soft tissues, and the associated changes in bone as of secondary origin Changes in bone occurring in Raynaud's disease and scleroderma have also been classified as neurotrophic The etiology of these two diseases remains obscure and the exact mechanism by which the bone becomes involved is unknown While

FIG 7 Fifty five year old man with a history of "foot trouble" for twenty-five years The process began as an injury to the toes followed by infection which persisted Finally the great toe was removed, but the chronic inflammatory process persisted The roentgenogram demonstrates rather extensive changes in bone

these bone changes may bear some relationship to the lesions which we have described, we believe that the former are sufficiently characteristic to distinguish them from changes secondary to infection of contiguous soft tissue

In this country leprosy is seldom seen and our experience does not warrant any statement as to the pathogenesis of the lesions of bone encountered in that disease

ROENTGENOGRAPHIC FINDINGS

In our definition of the so-called neurotrophic changes in bone we stated that there was a decrease of the caliber of the phalanges and metatarsals and absorption of the heads of these bones, with gradual atrophy of the shafts and "pencil-pointing" of the distal ends of the remaining shafts

The earliest roentgen finding is osteoporosis of the metatarsal bone or phalanx in the region of the soft-tissue involvement This is soon followed by a break

in the cortex, usually near the head of the metatarsal bone or phalanx, with further continued osteoporosis The periosteum, as a rule, shows some thickening or proliferative activity along the shaft of the involved bone The head of the bone is usually involved first and is gradually absorbed The remaining cortical portion of the bone is the last to go, and the distal end of the shaft of the metatarsal bone or phalanx becomes involved The medullary portion of the bone disappears, and the cortical walls are approximated, thus producing the pencil-shaped appearance The process of osteoporosis and absorption may continue until the bone is entirely gone If, however, the inflammatory process is checked for some reason at any point in the progress of the disease, there may be no further destruction Thus, since the lesion may be halted at any point in its progress, roentgenograms may be obtained showing any stage of the process, and varying degrees of absorption and destruction may be demonstrated Depending on the extent of the infection, a variable number of metatarsal bones or phalanges may be involved The extent of involvement depends on how extensive the infection is, how good the blood supply to the extremity happens to be, how long the infection has been present, how much general resistance to the infection the patient may present, and many other possible complicating factors The extent of the infection and its duration are of the chief significance

CONCLUSIONS

Lesions of the bones of the feet which have been described by certain writers as "neurotrophic" may be produced by a wide variety of systemic and local diseases A review of 61 cases in which the roentgenograms of the feet presented evidence of such "neurotrophic change" revealed that in every case there was infection of contiguous soft tissue, while diseases of the nervous system were present in only a small proportion It is believed, therefore, that the assumption that these bony changes are due to neurotrophic disturbance is invalid, and that they are rather to be attributed to a type of osteomyelitis secondary to chronic infection of the contiguous soft tissues

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DISCUSSION

David G Pugh, M.D (Rochester, Minnesota) Dr Hodgson, Dr Young, and I are fortunate that our paper has followed the excellent presentation by Drs Heilbrun and Kuhn,[1] since we believe that there is a resemblance between some of the lesions they have described and those we have studied. They found in their cases that infection of the adjacent soft tissue was always present when erosive changes of the trochanters of the femurs occurred, and that lesions of the trochanters did not occur in their patients with paraplegia unless infection of the adjacent soft tissue was present We found that in our cases lesions of the bone were always associated with chronic infection of the adjacent soft tissue, and that in many of our cases there was no disturbance of the nerves supplying the affected part Thus, it seems there is good evidence that in our cases and in those presented by Drs Heilbrun and Kuhn the lesions of the bone really are osteomyelitis secondary to chronic infection of the adjacent soft tissue, and there is no evidence to support the concept that these lesions of the bone result from a neurotrophic disturbance proper

[1] Erosive Bone Lesions and Soft-Tissue Ossifications Associated with Spinal Cord Injuries (Paraplegia) Radiology 48 579–592, June 1947

SUMARIO

Aspecto Radiológico de Ciertas Lesiones, Neurotrofas o Infecciosas, de los Huesos

Las lesiones de los huesos de los pies que ciertos autores han denominado "neurotrofas" pueden ser ocasionadas por afecciones generales y locales muy diversas

En 61 casos en los que las radiografías podálicas contenían signos de tales alteraciones "neurotrofas," un estudio ulterior reveló que en todos los casos había infección del tejido blando contiguo, mientras que sólo había neuropatías en una pequeña proporción Opínase, por lo tanto que no tiene razón de ser la suposición de que dichas alteraciones se deban a trastornos neurotrofos, debiendo más bien imputarse a una osteomielitis secundaria a infección crónica de los tejidos blandos

Calcium, Phosphorus and Phosphatase as Aids in the Diagnosis of Bone Lesions

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BONE DISEASES may in most instances be recognized by x-ray and clinical examinations In certain cases, however, correlation of all available data, including laboratory criteria, is necessary for a correct diagnosis An attempt will be made here to review calcium, phosphorus, and phosphatase determinations and other procedures as they relate to the diagnosis of diseases of the bone

The serum calcium, phosphorus, and phosphatase values vary with age (11) The normal *serum calcium* ranges from 9 5 to 10 5 mg per 100 c c for adults, 10 0 to 11 5 mg for children, and 10 5 to 12 0 for infants The *serum phosphorus* ranges from 2 5 to 4 0 mg per 100 c c for adults, 4 5 to 5 5 mg per 100 c c for children, and 5 5 to 6 5 mg per 100 c c for infants, it should be determined on serum which is free of hemolysis

The serum calcium is composed of two fractions the diffusible calcium (nearly all ionized) and the non-diffusible calcium, the latter constitutes about 45 per cent of the total and is bound to protein Hence, its amount depends on the amount of protein or, somewhat more specifically, on the amount of albumin That protein and calcium are closely bound has been demonstrated by ultracentrifuge experiments The effect of the protein concentration on total calcium has been emphasized by McLean and Hastings (13) and by Albright and his co-workers (2) McLean and Hastings devised a graph for calculating the ionized fraction and the protein effect When there is no renal insufficiency or hyperglobulinemia, 1 gram of protein binds approximately 0 75 mg of calcium (This is only an approximation but gives an idea of the effect of the lowering of serum protein by 1, 2, or 3 grams, as in nephrosis or malnutrition) Failure to recognize the protein effect sometimes obscures an actual hypercalcemia in hyperparathyroidism, or in other instances may lead to the false assumption of hypocalcemia

TABLE I NORMAL VALUES FOR SERUM PHOSPHATASE (20) UNITS PER 100 C C SERUM

	Acid (pH 5 0)	Alkaline (pH 8 6–9 3)	
	Adults	Adults	Children
Bodansky*	0 0–0 4	1 5–4 0	5 0–12 0
King-Armstrong†		3 7–13 1	15 0–20 0
King-Armstrong† (Gutman's Modification)	0 0–3 25		

* Substrate Sodium β glycerophosphate (unit based on 1 mg phosphorus)
† Substrate Di-sodium phenylphosphate (unit based on 1 mg phenol)

The phosphatase activity of serum has been extensively studied for many diseases On the basis of activity at different *p*H ranges, phosphatases may be divided into four types (1) an alkaline type with optimal activity at about *p*H 9 3, found in bone, ossifying cartilage, intestine, kidney, mammary gland, lung, spleen, blood serum, leukocytes, and the adrenal cortex, (2) a phosphatase with optimum activity at *p*H 6 0, found in mammalian erythrocytes, (3) a phosphatase with optimum activity at *p*H 5 0, found in spleen, liver, pancreas, kidney, prostate, and serum, (4) a phosphatase in certain yeasts with optimal activity at *p*H 3 0 to 4 0 Clinically we are concerned with two of these groups, namely, the alkaline at *p*H 8 6 to 9 3 and the acid at *p*H 5 0 The erythrocyte phosphatase can be dismissed with the statement that hemolysis-

[1] From the Department of Internal Medicine University of Minnesota Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago Ill , Dec 1–6 1946

free serum should be used for the determination of both phosphatases, but especially the acid phosphatase

Unfortunately, many methods for determining phosphatase activity are in use, each with a different set of standards The units are different primarily because of differences in the substrate employed In the Bodansky method the phosphorus liberated during incubation of serum with β-glycerophosphate is determined, in the King-Armstrong method the amount of phenol liberated during incubation of serum with disodium phenylphosphate is measured There is an approximate ratio of 1 to 3 between the molecular weights of phosphorus and of phenol, and this difference accounts chiefly for the difference between the range of normal values obtained by the two procedures

A list of diseases in which the alkaline phosphatase is elevated regularly or frequently enough to be of importance in the differential diagnosis is given in Table II If one excludes regurgitation jaundice or liver damage, there are many direct and some indirect indications that increased phosphatase activity depends on osteoblastic activity In Paget's disease of bone particularly, the osteoblastic activity predominates over the osteoclastic process, and the phosphatase is uniformly elevated when sufficient bone is involved

In hyperparathyroidism the height of the phosphatase is correlated with the extent of bone disease At first glance it is correlated, then, with the degree of decalcification as evidenced by x-ray examination A case has been reported by Albright *et al* (2) in which the phosphatase was normal in the phase of extensive osteitis fibrosa cystica generalisata Biopsy in this patient revealed inactive bone and fibrous tissue replacement of bone Phosphatase is increased in rickets and osteomalacia where there is attempted bone repair and an abundance of osteoid tissue Multiple myeloma is characterized primarily by destruction of bone with minimal attempt at repair, and the phosphatase is usually normal It is reasonable then to state that in the absence of jaundice phosphatase activity depends on osteoblastic activity

TABLE II DISEASES SHOWING ABNORMAL PHOSPHATASE VALUES (20)

Diseases in Which Alkaline Phosphatase May Be Elevated
Rickets
Osteomalacia
Paget's disease of bone
Renal rickets (or renal osteodystrophy)
Hyperparathyroidism with osteitis fibrosa cystica generalisata
Neurofibromatosis of bone or osteitis fibrosa cystica diffusa
Osteogenic sarcoma
Carcinomatous metastases to bones
Hodgkin's disease (and other lymphoblastomas) involving bone
Boeck's sarcoid
Carcinoma of the prostate with metastases
Jaundice of regurgitation type
Extensive fractures in healing phase
Last trimester of pregnancy
Diseases with Abnormally Low Phosphatase
Cretinism
Scurvy

Because of the large number of conditions in which the serum phosphatase is elevated, this finding is not pathognomonic of any single disease, but when correlated with other findings it is of great usefulness The significance of acid phosphatase is very special and relates only to carcinomatous metastases from the prostate

Calcium Excretion Careful and laborious calcium balance studies are necessary to determine whether or not the patient has a net gain or loss of calcium in a given period The ratio of stool to urine calcium is of importance Normally about two-thirds of calcium is excreted in the feces and one-third in the urine This ratio changes most markedly in diseases of the parathyroid gland In hyperparathyroidism a larger percentage is excreted in the urine, in a quantity which leads to a negative calcium balance The ratio is shifted in all hypocalcemic states so that a larger portion, or often all the calcium, is excreted in the feces

Determination of the quantity of urine calcium has proved to be of use clinically When a patient is on a restricted calcium, neutral ash diet, the calcium excretion can be measured reasonably accurately by an

TABLE III DIFFERENTIAL DIAGNOSTIC FEATURES OF DISEASES WITH DISTURBED CALCIUM AND PHOSPHORUS METABOLISM

Condition	Serum			Urine		Feces
	Ca	P	Phosphatase (Alkaline)	Ca	P	Ca
Hyperparathyroidism	I	D	N to I	I	I	N
Hyperthyroidism	N	N	N to I	I	I	I
Paget's disease	N	N	I	N to I	N	
Multiple myeloma	N to I	N	N	N to I	N to I	
Rickets	N	D to N	I	D	D	
Osteomalacia	D to N	D	I	D	D	D
Idiopathic steatorrhea	D to N	D to N	N to I	D	D	I
Renal rickets	D to N	I	I	D	D	
Osteogenic sarcoma	N	N	N to I	N	N	
Metastatic carcinoma	N to I	N	N to I	I	I	
Prostatic carcinoma	N to I	N	I			
Neurofibromatosis	N to I	D to N	N to I			
Uremia	D	I	N	D	D	
Regurgitation jaundice			I			
Hyperproteinemia	I	N				
Hypoproteinemia	D	N				
Acidosis	N	N				
Alkalosis	N	N		N	N	
Hypoparathyroidism	D	I	N	D	D	N
High vitamin D therapy	I	I	N	I	I	

N, Normal D, Decreased I Increased

adaptation of the Sulkowitch test to the Evelyn photoelectric colorimeter (15) A normal individual excretes less than 100 mg per day In hyperparathyroidism and hyperthyroidism this amount is greatly increased, usually to over 200 mg per day The excretion may be excessive in any disease with rapid decalcification of part or all of the skeleton When correlated with other laboratory tests, as indicated in Table III, observation of the renal excretion of calcium under controlled conditions is important

An attempt will be made to review diagnostic and other interesting features of some bone diseases Other specific laboratory procedures will be mentioned in the discussion

Hyperparathyroidism The following case history of a patient with a parathyroid tumor illustrates some of the important diagnostic criteria for hyperparathyroidism

G M, a 59-year-old male, was admitted to the hospital on April 2, 1944 Two years earlier he had fallen and injured his left knee. Since that time he had suffered from pain in the lower back, in the hips, and both lower extremities The pain was deep-seated, often shooting in character, and severe enough to require opiates for relief There was a history of weakness for twelve years, progressively interfering with the patient's work in the past three years For twenty-five years he had experienced polydipsia of varying intensity, sometimes drinking as much as two gallons of water in a day There were no other renal symptoms There had been a loss of 30 pounds in weight over a two-year period, in spite of a good appetite

The patient appeared well developed but poorly nourished, weighing 120 pounds He had a lumbar lordosis and a slight thoracic kyphosis His blood pressure was 113/72 A small mass was palpable below the right sternomastoid muscle This mass moved on swallowing

Laboratory Findings The hemoglobin was 12 1 gm per 100 c c , leukocyte and differential counts were normal The blood urea nitrogen was 45 mg per 100 c c and the creatinine 2 3 mg per 100 c c before surgery Several weeks after surgery the blood urea nitrogen had decreased to 17 mg per 100 c c Calcium 17 6–14 2 mg /100 c c , phosphorus 4 2–2 2 mg /100 c c , alkaline phosphatase 50 King-Armstrong units

X-ray examination of the skeleton revealed changes typical of osteitis fibrosa cystica generalisata The skull particularly had a granular appearance, with minute cystic areas

Course In May 1944, Dr Richard Varco removed a parathyroid tumor weighing 20 gm from the region of the lower pole of the right lobe of the thyroid The adenoma was composed predominantly of chief cells In some areas there was a tendency to rosette formation and gland formation Normal parathyroid glands were identified on the left side

On the seventh postoperative day definite but mild symptoms of tetany occurred For several days the Chvostek and Trousseau signs were positive, remaining so for four or five days thereafter The patient received 1 0 gm of calcium gluconate on three occasions with satisfactory response During one month postoperatively he received 3 75 mg of dihydrotachysterol and 6 0 to 24 0 gm of calcium lactate orally every day He has been feeling well, has only occasional aching pains, has gained 30 pounds in weight, and serum calcium, phosphorus, and phosphatase are normal He still has renal insufficiency, P S P excretion is 24 per cent in two hours

Primary hyperparathyroidism occurs more frequently in females than in males, in a ratio of 2 to 1 The symptoms are referable to the musculoskeletal, genitourinary, and gastro-intestinal systems There are two types of the disease (5) primary hyperplasia of all the glands, involving the "wasserhelle" or water-clear, cells, and adenoma formation limited to one or rarely two glands It is important to differentiate these types at operation so as not to overlook other hyperplastic glands when one enlarged gland is found and thus mistake it for a solitary adenoma

The calcium is usually greater than normal and the phosphorus is low It is often necessary to repeat the determinations several times, for normal values may be found on any single determination If renal insufficiency is great enough to cause retention of blood urea nitrogen, the phosphorus is increased to a normal level or even above and the calcium may be decreased to normal The serum phosphatase is elevated only when there is skeletal involvement More calcium is excreted in the urine than normal unless there is severe renal insufficiency

Hyperparathyroidism is frequently a hidden disease, and its consistent recognition will depend upon x-ray and laboratory studies X-ray examination should be done in all patients who have musculoskeletal symptoms This fact is so well known that the statement seems to be trite, but it is surprising how many patients with definite chronic musculo-skeletal symptoms are not given the benefit of roentgen examination Investigation of every patient who has symptoms of renal calculi and of mild polyuria and polydipsia for urine calcium (by the Sulkowitch test) and serum calcium, phosphorus, and phosphatase, will lead to a positive diagnosis of hyperparathyroidism in a number of cases which would otherwise be unrecognized and go untreated

The bone lesions in this disease have received enough emphasis so that the matter is fixed in all of our minds What is less well known is the serious renal damage which occurs in untreated hyperparathyroidism even if it be relatively mild Renal stones are frequent and can cause hydronephrosis, pyelonephritis, etc , with all the attendant sequelae of calculi The parenchyma of the kidney may become calcified, causing serious or irreversible renal insufficiency and eventually uremia (nephrocalcinosis) Acute parathyroid poisoning may cause anuria also The seriousness of renal involvement is apparent from the fact that 4 out of 6 patients recently studied have shown definite renal insufficiency and 2 of these have severe hypertension (7) Keating and Cook (25) have re-emphasized the importance of examining patients with renal calculi for hyperparathyroidism

The phosphatase activity in parathyroid disease has a special significance aside from its diagnostic value The probability of the development of tetany after removal of a parathyroid adenoma or hyperplastic glands is much greater in patients with high values than in those with normal levels The tendency to tetany can serve as a measure of the completeness of surgery in patients with extensive bone disease The reason, of course, is that phosphatase is a measure of osteoblastic activity and this in turn is a determinant of the avidity with which the bone takes up calcium

There is but one adequate form of treatment of hyperparathyroidism once a diagnosis has been made and that is by surgical removal of the adenoma or subtotal resection of hyperplastic glands Cope (6) reviews the surgical principles, including

location and treatment of mediastinally placed parathyroids

Osteomalacia Reported elsewhere in the world as the result of frank calcium and vitamin D deprivation, osteomalacia has been recognized in this country chiefly as the result of chronic mild steatorrhea (16) When steatorrhea begins in adult life, osteomalacia may not occur, but hypocalcemia and tetany may be very troublesome and are sometimes the presenting symptoms A low calcium and phosphorus, decrease in urine calcium excretion, and an increase in phosphatase characterize osteomalacia The following history is illustrative of such cases

E W , a 28-year-old male, stopped growing at age of 12 For the last six years he had experienced aching pains in the arms and legs, numbness and paresthesia in the hands and feet especially during winter months, progressive deformity of the sternum and ribs, tenderness of the ribs, and pain in the left hip on weight-bearing He had never been able to do very much work because of weakness He had had a diarrhea with passage of two to four fatty bulky stools daily since early childhood

On examination the patient appeared obviously dwarfed, he weighed only 60 pounds and was 46 inches tall He had marked kyphoscoliosis, pigeon-breast deformity of the chest, and coxa vara deformity of both hips He was unable to walk without use of a crutch There was a bilateral chronic otitis media The Trousseau and Chvostek signs were positive The abdomen was distended and tympanitic

Laboratory Tests Urinalysis and the phenolsulfonphthalein test were normal The blood urea nitrogen was normal Serum calcium determinations showed 6 9, 7 8, and 7 6 mg per 100 c c (when the serum protein was normal) and serum phosphorus levels of 2 5, 2 3, and 3 3 mg per 100 c c The serum alkaline phosphatase was 46 King-Armstrong units A secretin test revealed normal pancreatic function With a high-calcium diet and vitamin D (100,000 units a day), the calcium rose to 9 2 and 10 3 mg and symptoms of tetany disappeared

X-ray examination of the skeleton revealed very striking osteomalacia with extreme decalcification of all the bones of the body The cortex of the long bones was paper-thin and there were horizontal lines of compression The pelvis was extremely contracted

Paget's Disease Reifenstein and Albright (18) have reported acute atrophy of bone in Paget's disease The following case illustrates this feature

C L , a 63-year-old man, suffered a fracture of the left femur Nov 1, 1931 He had deep seated pain in the left thigh for six months He had gradually lost his hearing over a ten-year period, and there had been pain and tenderness of the skull intermittently since 1929 He was admitted to the University Hospital in February 1932 because of failure of proper healing of the fracture after twelve weeks of immobilization

Examination on admission to this hospital in 1932 showed shortening and bowing of the left femur The left thigh was larger than the right Very few laboratory tests were carried out, but serum calcium and urinalysis were normal X ray examination revealed marked subperiosteal decalcification and a pathological fracture of the left femur with partial union There was typical Paget's disease of the pelvis, skull, and whole left femur A walking caliper was supplied, and in four months remarkable improvement occurred, as evidenced by recalcification of the femur

When there is immobilization of fractures in extremities involved in Paget's disease, acute atrophy of the bone occurs In the cases studied by Reifenstein and Albright there were hypercalcemia, polydipsia, polyuria, and renal disturbances during the height of the decalcifying process Under ordinary circumstances, however, the calcium and phosphorus are normal When a single bone is involved, the serum phosphatase may be normal, but it is usually increased considerably when the involvement is multiple

Paget's disease is never generalized It is chronic and tends to be progressive Pain in part of the skeleton is frequent and may be disabling, but often the disease is discovered accidentally when x-ray examinations are done for other purposes There is a 10 per cent incidence of renal stones in patients with Paget's disease (19) Deformities, particularly of the skull, may be disfiguring A pathological fracture may be the first symptom When fractures do occur, it has been demonstrated that as little immobilization as possible should be allowed because of the probability of acute atrophy mentioned above The etiology of Paget's disease is as yet undetermined That the disease is not endocrine in origin is evident from its localization in certain bones while others remain uninvolved

TABLE IV LABORATORY FINDINGS IN EIGHT CASES OF MULTIPLE MYELOMA (11)

	Ca	P	Ptase	NPN	Alb	Glob	Eug	TP	BJP
MM	10 3	2 8	2 4	35	3 3	6 9	5 5	10 2	Neg
AR	11 7	3 8	3 5	22	2 8	3 4		6 2	Pos
MH	12 3	4 2	1 8	31	3 0	6 3	0 2	9 3	Neg
PL	12 5	5 2	2 3	51	2 7	10 1	7 1	12 8	Pos
CJ	16 6	4 5	5 1	82	4 8	1 9	0 5	6 7	Neg
EC	17 8	4 4	2 5	61	4 1	2 8	0 9	6 9	Neg
JM	14 1	5 3	2 6	57					
JB				107	2 0	14 0	11 3	16 0	

This table shows blood chemistry values in 8 individual cases of multiple myeloma, phosphatase activity (Ptase), value (Bodansky), euglobulin value (Eug), and Bence Jones protein (BJP)

Multiple Myeloma The following case is illustrative

L O , a 60-year-old white woman, had been ill for six months She had severe pains in the back and in the flanks and extremities on weight-bearing She had lost 30 pounds weight because of severe anorexia On examination she was emaciated and pale She had so much bone tenderness that she would cry out whenever she was moved in bed No viscera were palpable

Laboratory Findings The hemoglobin was 7 0 gm per 100 c c , blood urea nitrogen 60 mg per 100 c c , sedimentation rate 142 mm in twenty minutes Total protein was 7 3 gm per cent, albumin 3 3 gm per cent, and globulin 3 5 to 3 7 gm per cent Serum calcium was 11 mg to 15 mg per 100 c c , phosphorus 5 6 and 5 76 mg per cent Bence-Jones protein was found in the urine Alkaline phosphatase determinations showed 5 to 8 3 King-Armstrong units

X-ray examination of the pelvis, spine, skull, and chest revealed an extreme grade of osteoporosis with multiple rarefied areas throughout all the bones examined There was collapse of two vertebral bodies The findings were interpreted as indicating widespread carcinomatous metastases or multiple myeloma

The patient remained approximately the same during two months of hospitalization She was not followed after discharge but undoubtedly has succumbed by this time

In multiple myeloma the serum calcium is often increased but the phosphorus is unchanged The serum phosphatase is practically always normal There is usually an increased excretion of calcium in the urine Whenever the erythrocyte sedimentation rate is extremely rapid, multiple myeloma should be suspected, but the sedimentation rate is not always markedly elevated The blood smears often have a greasy appearance because of a tendency to rapid rouleau formation Accurate red blood cell counts are difficult for the same reason Bence-Jones protein appears in the urine in a majority of cases, but it is not pathognomonic of multiple myeloma Sometimes it is found only after repeated careful testing with nitric acid as originally discussed by Bence-Jones Hyperglobulinemia occurs frequently and may be extreme Accurate pathologic diagnoses are possible during life by means of sternal marrow aspiration or sternal biopsy, and these procedures should be carried out in all suspected cases

The laboratory findings in a group of cases of multiple myeloma studied by Jaffe and Bodansky (11) are given in Table IV Special note should be made of the phosphatase activity, which is normal or only slightly elevated, and the serum calcium values, most of which are elevated, also of the incidence and the extent of hyperglobulinemia and the presence of Bence-Jones protein in the urine

Hyperthyroidism with osteoporosis is illustrated by the following case

Mrs C L , a 64-year-old white female, manifested symptoms of hyperthyroidism and had a subtotal thyroidectomy in 1927 She had a recurrence and another operation in 1928 She was never completely symptom-free nor was her basal rate normal up to the time of her first observation in this hospital in 1935 She took Lugol's solution continuously until 1935 She first complained of pain in the back in 1935 and became quite stooped in a few years She began drinking extra milk and taking viosterol in 1936 and her pain decreased A gradual increase in kyphosis occurred from 1936 to 1943 On examination, she was found to have a hypertension and moderate tachycardia, she was malnourished and had marked kyphosis of the thoracic spine Exophthalmos, stare, and lid-lag were observed at each of four hospital admissions from 1935 to 1943

Laboratory Findings Urinalysis was negative Hemoglobin was 14 gm per 100 c.c. Leukocyte

counts were normal, with a tendency to lymphocytosis most of the time The basal metabolic rates were +41 to +3 per cent (always over +20 per cent until 1943) Serum calcium was 10 4 mg per cent in 1936, 10 1 mg per cent in 1939, and 8 8 and 12 2 in 1942 Serum phosphorus ranged from 2 9 to 2 7 mg per 100 c c No phosphatase determinations were carried out

X-ray examination showed osteoporosis of extreme grade with multiple compression fractures of the thoracic and lumbar vertebrae in 1935 All parts of the skeleton studied showed osteoporosis There was an increase in degree of kyphosis in 1943, but the osteoporosis was about the same Three courses of x ray therapy to the thyroid were given—one in 1935 and two in 1943 Apparently the hyperthyroidism was finally controlled in 1943

Hyperthyroidism is an important cause of osteoporosis because of the increased excretion of calcium and phosphorus in the urine and feces (23) It is difficult to maintain a positive calcium balance during the active phase of hyperthyroidism, but with prompt treatment osteoporosis does not develop In chronic hyperthyroidism, however, a continued negative calcium balance eventually manifests itself as extreme osteoporosis Another factor, namely postmenopausal osteoporosis, undoubtedly contributes to the condition of the bones in some patients

Osteoporosis A careful study of postmenopausal osteoporosis has been made by Albright and co-workers (3) Senile osteoporosis (including the postmenopausal variety) is characterized by normal serum calcium, phosphorus, and phosphatase values The urine calcium excretion is not usually increased, but there must be a long maintained negative calcium balance for the bone to become so decalcified Rarely the serum calcium, phosphorus, and phosphatase may be elevated, but repeated examinations usually fail to reveal a maintained abnormality (24) The sedimentation rate is usually only slightly elevated or normal in osteoporosis, whereas in carcinomatosis and multiple myeloma it is usually very rapid The most important symptoms are weakness, fatigue, and aching in the lower back The ache gradually grows worse and finally becomes a constant pain, sometimes very severe, especially on bending or jarring the back

Carcinoma of the prostate with metastases to the skeleton is in general characterized by a high serum acid phosphatase

P N , a 70-year old man, had been extremely weak for three or four months He had so much pain in the back that he was bedridden Nausea and vomiting with hematemesis first occurred the day before hospital admission There was a history of nocturia for two years and frequency for a month

On examination the patient was cachectic, extremely pale, and in constant agony, appearing practically moribund He had arthritic deformities of hands and feet and ecchymoses in the epigastrium and on the left leg The landmarks of the prostate were completely obliterated and the gland was firm and irregular

Laboratory Findings Urinalysis showed specific gravity 1 018, no albumin, an occasional white blood cell Hemoglobin was 3 6 gm per cent, blood urea nitrogen 48 mg per cent on admission but 14 mg per cent ten days later The reticulocyte counts were 13 per cent and 18 per cent on the 3rd and 5th days after starting therapy with stilbestrol The serum calcium was 9 3 mg per cent and the serum phosphorus 2 3 mg per cent The phosphatase values were as follows

Acid phosphatase (K A units)	
Before therapy	10 4
Nine days after therapy	3 1
Five months later (no therapy for two to three months)	4 8
Twelve months later	2 3
Alkaline phosphatase (K A units)	
Before therapy	8 7
Nine days after therapy	20 0
Five months later (no therapy for two to three months)	14 6
Twelve months later	12 9

X-ray examination showed extensive osteoblastic metastases in the lumbar spine, pelvis, and ribs, and evidence of an old ankylosing spondylitis At five months the process was not very different, but the osteoblastic metastases were somewhat less dense The patient received 5 mg stilbestrol daily orally and improved remarkably Only one blood transfusion was given and yet his hemoglobin rose from 3 6 to 8 3 gm per cent in two weeks His pain was controlled so well that he was able to be up and about again in a week He has been symptom-free for a year He voluntarily stopped stilbestrol for two and a half months, and though he had no recurrence of pain his acid phosphatase increased slightly For six months he has been taking 1 mg of stilbestrol regularly and has no pain

The skeletal metastases of carcinoma of the prostate occupy a unique place among

bone diseases Elevated values for serum acid phosphatase occur in about 85 per cent of the cases of prostatic carcinoma (9) Prostatic tissue has a high acid phosphatase content, as does also carcinoma of the prostate unless it is very undifferentiated Huggins and Hodges (10) were the first to demonstrate clearly the effectiveness of castration or estrogen therapy in these cases and the dramatic change in acid phosphatase as improvement occurred Acid phosphatase is markedly elevated only in metastasizing carcinoma of the prostate, however, slight elevations may be seen in patients with very high alkaline phosphatase, as in Paget's disease, hyperparathyroidism, and metastatic carcinoma from the breast One more interesting item of evidence is the effect of testosterone propionate, which causes an increase in an already high acid phosphatase and an exacerbation of symptoms

Renal osteodystrophy (renal rickets or renal dwarfism) is illustrated by the following case

G B , a 12-year-old boy, began to limp in January 1944 He had had pain in the bones and joints for two years He had urinary frequency and poor bladder control until three or four years previously Dysuria and frequency began again one year and hematuria occurred six months before admission At the age of three, albumin was found in the urine On examination the boy was found to be obviously dwarfed He had a coated tongue and a uriniferous breath His skin and mucous membranes were pale His blood pressure was 106/80 to 110/70

Laboratory Findings The specific gravity of the urine was 1 005 to 1 011, albumin 0 to +, 0 to occasional red blood cells The phenolsulfonephthalein test showed an output of 7 5 per cent in two hours The hemoglobin was 7 5 gm , red blood cell count 2,600,000, blood urea nitrogen 66 mg per cent (increased to 132 mg six months later), creatinine 5 1 mg per cent, carbon dioxide combining power 39 volumes per cent The serum calcium were 9 1 to 12 4 mg per 100 c c , serum phosphorus 6 2 to 8 8 mg per 100 c c alkaline phosphatase 58 King-Armstrong units per 100 c c , serum protein 6 4 gm per 100 c c with normal fractional proteins

X-ray examination showed a marked diminution in the development of the epiphyses of the long bones, deformity of the costochondral junction of all ribs The appearance at the elbow and shoulder was that of a six- or seven-year old child All the bones had a granular decalcified appearance Marked changes characteristic of rickets in the ends of the metaphyses at the epiphyseal line were also present in all the bones Both kidneys were small There were marked saucering of the ends of the bones of the lower extremities, flaring of the epiphyseal line, and ragged and irregular bone formation

Renal osteodystrophy occurs in children with chronic renal insufficiency from any cause (usually developmental anomalies) which is severe enough to cause retention of non-protein nitrogenous substances and inorganic acid radicals, namely phosphate and sulfate (1) Mild acidosis is the rule The most important chemical finding is a retention of phosphorus The kidney is unable to excrete phosphates in normal amounts A plausible theory for the parathyroid hyperplasia in these cases is that the high phosphate stimulates the glands to hypertrophy and this in turn causes secondary hyperparathyroidism Hypertension usually does not occur in these children

Renal osteodystrophy can occur in adults but, of course, without the changes at the epiphyses (1) Actually, secondary hyperparathyroidism with osteitis fibrosa occurs The uremia has to be of long duration and there always is a moderate acidosis Metastatic calcification of subcutaneous tissue is common and has been found in arteries, soft tissues in the neighborhood of joints, subcutaneous tissues, lungs, stomach, liver, and heart muscle

The pathology of the parathyroid gland (5) in renal osteodystrophy must be sharply differentiated from that of primary hyperplasia of the parathyroids, which is characterized by "wasserhelle" cell hyperplasia In secondary hypertrophy, the chief cells are the predominant ones

DIFFERENTIAL DIAGNOSIS OF BONE DISEASES

Table III is a schematic representation of specific disturbances in the various diseases of bone though it is not possible to cover every possibility in a given disease Calcium and phosphorus are reciprocally related in most instances, so that when calcium is elevated the phosphorus is low, and *vice versa* When there has been calcium, phosphorus, and vitamin depriva-

tion in rickets, steatorrhea, etc , both calcium and phosphorus may be low, or one or the other normal

Primary hyperparathyroidism has to be differentiated from multiple myeloma, neurofibromatosis with osteitis fibrosa cystica disseminata, Paget's disease, hyperthyroidism with osteoporosis, senile osteoporosis, hypervitaminosis D, and renal calculi of non-endocrine origin A correlation of all findings is important in studying any single case

Other features of bone diseases require comment Hyperparathyroidism causes diffuse and generalized bone disease so that x-ray studies of any portion of the skeleton will reveal changes Paget's disease is never generalized, so that x-rays will reveal normal bone in part of the skeleton at least In fact, one part of a single bone may be normal and another part show typical osteitis deformans Multiple myeloma may be generalized so that its appearance is confusing, but the adjuncts to diagnosis—namely, examination of the urine for Bence-Jones protein, hyperglobulinemia, bone marrow study by aspiration or biopsy, and determination of the sedimentation rate—are helpful

Carcinomatosis is apt to be confused with multiple myeloma or even hyperparathyroidism Recognition of metastases in the lungs or regional lymph nodes is suggestive of the diagnosis Discovery of a primary tumor by biopsy of a lymph node is also of considerable aid From the table it is evident that the biochemical findings in multiple myeloma and carcinomatosis overlap, so that differentiation must be made on other grounds

The bone lesions of neurofibromatosis are never generalized and there are stigmata of neurofibromatosis including *cafe au lait* spots Thannhauser (22) believes that neurofibromatosis is associated with the bone lesions occuring in a syndrome which has been called polyostotic fibrous dysplasia of bone (12), xanthomatosis generalisata ossium (19), and osteitis fibrosa disseminata with areas of pigmentation and endocrine dysfunction with precocious puberty in females (4) The controversy on the subject of this syndrome is summarized by Albright (4), and it appears that polyostotic fibrous dysplasia is the best name to apply to this bone disease It occurs at an early age, involves more than one bone, but is never generalized and is often bizarre in its local roentgen appearance, it is commonly associated with areas of cutaneous pigmentation, and occasionally with precocious puberty in thef emale Renol and muscular symptoms are absent The biochemical findings (listed under neurofibromatosis in Table III) may resemble those of mild hyperparathyroidism, the alkaline phosphatase particularly tending to be high, so that unnecessary operations have been performed

Secondary hyperparathyroidism such as occurs in renal insufficiency may lead to an osteitis fibrosa cystica generalisata which is identical with the primary disease The biochemical findings are the important differential feature, particularly the high phosphorus and low or normal calcium When renal insufficiency is due to primary hyperparathyroidism, the characteristic high calcium and low phosphorus may become normal calcium and high phosphorus, and it becomes difficult to differentiate the two conditions, it is usually possible to do so, however, from the chronology of the symptoms and other manifestations Moderate or severe skeletal changes are unusual in primary renal disease, and renal insufficiency severe enough to cause a considerable hyperphosphatemia is rare and of late occurrence in primary hyperparathyroidism Occasionally pathological examination of the parathyroid glands is crucial in making this differential diagnosis

Chronic hyperthyroidism causes osteoporosis and increased excretion of both calcium and phosphorus, but there usually are normal serum calcium and phosphorus levels (23) Other evidences of hyperthyroidism are present Hyperthyroidism should be considered as a possible cause of osteoporosis occurring before senility It is noteworthy that renal insufficiency and

renal calculus formation do not occur as a result of hyperthyroidism in spite of increased calcium and phosphorus excretion in the urine

Skeletal metastases from carcinoma of the prostate, as has been pointed out, occupy a unique place among bone diseases because of the increased serum acid phosphatase activity in a great majority of cases One must not exclude this diagnosis from consideration, however, just because of a normal acid phosphatase activity

In conclusion, emphasis should again be placed on the importance of a careful study of all patients with skeletal complaints, by x-ray examination of the part causing symptoms (and others as indicated on consultation with the radiologist) and by chemical determinations, especially serum calcium, phosphorus, phosphatase, and protein, and urine calcium

NOTE The author wishes to acknowledge the help of Dr L G Rigler in selecting cases and discussing them from the roentgenologic standpoint and to Dr G T Evans for help and encouragement in preparing the manuscript and in arranging some of the tables

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DISCUSSION

Leo G Rigler, M D (Minneapolis, Minn) Some time ago I pulled a kind of a grandstand play, as many of us like to do from time to time, and mystified my own residents and the pediatric residents The intern on pediatrics brought me some films on a six-year-old child who had been admitted because of a severe anemia The films of the bones

had been made because it was believed that the child had a congenital hemolytic anemia and that some of the usual findings might be observed Upon looking at the films, I suggested that blood chemistry studies be made, and predicted that the calcium would be around 6, the phosphorus around 8, and the alkaline phosphatase elevated Somewhat mystified, the young man rushed right back, got the chemistry done and found that the figures were approximately correct He returned to the X-ray Department taking his hat off and bowing low, trying to find out how I had known It was, of course, perfectly simple, since we were dealing with a typical case of renal rickets The anemia was due to uremia and the blood chemistry findings in such cases are almost inevitably those that I predicted

I cite this incident only because I think it is important for all radiologists to bear in mind the blood chemistry findings in the usual bone diseases I believe it would be wise for them to have, either in their minds or at their hands, a chart similar to Dr Flink's Table III

I suggested to Dr Goin that he put Dr Flink on the program since I think radiologists ought to be reminded from time to time that they need to have a knowledge of the blood chemistry in bone metabolic disturbances because first, such information will help a good deal in coming to a conclusive diagnosis in the difficult cases, second, a knowledge of the blood chemistry gives a much better conception of the metabolic changes which are taking place in the bone in the various conditions under consideration

I think it should be emphasized that there are cases of hyperparathyroidism which give characteristic blood chemical findings without any evidence whatever that most of us can detect in careful studies of the skeleton These cases are rare, it is true, but they do occur Likewise, there are cases of multiple myeloma with no bone findings but with fairly typical chemical findings such as Dr Flink described

In the differential diagnosis of certain conditions which occasionally give us a good deal of trouble—for instance, Paget's disease and carcinomatous metastases from the prostate, myeloma and multiple carcinomatous osteoclastic metastases—consultation and study of the blood findings may clarify the situation considerably when it is not entirely clear from the x ray findings alone

Edmund B Flink, M D (*closing*) I probably presented an over-simplified scheme for the diagnosis of bone diseases I am sure Dr Rigler will agree with me that the findings do not always fall into a definite category

I think that one should bear in mind always that a single laboratory determination may be fallacious and that repeated examinations should be made if one is suspicious of any particular condition

SUMARIO

El Calcio, el Fósforo y la Fosfatasa como Auxiliares en el Diagnóstico de las Lesiones Oseas

Si bien las osteopatías pueden ser reconocidas habitualmente por medio de los exámenes radiológicos y clínicos, las pruebas de laboratorio resultan indispensables en algunos casos—y en particular las determinaciones del calcio, el fósforo y la fosfatasa séricos y del calcio en la orina

Preséntanse casos de hiperparatiroidismo primario, osteomalacia, enfermedad de Paget de los huesos, mieloma múltiple, hipertiroidismo con osteoporosis, metástasis óseas del carcinoma prostático y osteodistrofia renal, discutiéndose las características importantes de dichos estados Los estudios roentgenológicos y las pruebas de laboratorio revisten importancia en el diagnóstico Una tabla expone los hallazgos diferenciales de laboratorio

Experiences With Nasopharyngeal Carcinoma[1]

VINCENT P GRAHAM, M D ,[2] and RALPH R MEYER, M D [3]

Chicago, Ill

IT IS FORTUNATE that malignant tumors of the nasopharynx are of rare occurrence Between 1932 and 1942 only 29 patients were admitted to this clinic with a nasopharyngeal cancer Because the nasopharynx is accessible only to the most careful rhinoscopist, this lesion is frequently missed Before admission to the clinic, more than half our patients were under the care of a physician and had one or more nasal operations directed toward the relief of symptoms without recognition of the primary lesion Other writers have recorded a similar experience (1, 2) New (3) reports that 185 operations had been performed on 194 patients before the underlying disease was recognized Of our 29 cases, 3 are not included in this study, since they received no x-ray therapy Most of the cases were treated and followed by Dr Anna Hamann

SYMPTOMS AND SIGNS

In 16 of the 26 patients, or 62 per cent, the chief complaint on admission was a cervical mass Others (4, 5, 6, 7) have reported an incidence of 35 to 77 per cent Cutler and Buschke (6) regard cervical adenopathy as the most frequent finding and usually the sign which brings the patient to a physician Pain referable to the temporal area, face, or side of the head was the next most common complaint, occurring in 6 patients It is this failure of the primary lesion to produce prominent local symptoms that accounts for the difficulty in diagnosing and dealing with nasopharyngeal cancer in an early stage

In all instances the rhinoscopists were able to visualize a nasopharyngeal mass or ulcer There was great variation in size, and in several cases a small ulcer could be seen behind the cushion of the eustachian tube or in the fossa of Rosenmuller This made biopsy very difficult

Eighteen of the 26 patients had palpable cervical lymph nodes, which again emphasizes the point that these patients appear for treatment in an advanced stage of the disease In 4 of these 18 patients, the lymph node enlargement was bilateral In 4 instances biopsy was done on the nodes and metastatic neoplasm was revealed

Cranial nerve signs were almost as frequent as involvement of cervical lymph nodes In 15 of the 26 patients one or more cranial nerves was involved—the trigeminal most frequently (10 patients), the sixth next (6 patients)

Middle-ear disease was noted in 9 of the cases Varying degrees of change in the ear drum, from redness to perforation with purulent discharge, were observed

X-RAY SIGNS

Films usually showed varying degrees of clouding of one or more of the paranasal sinuses The lateral skull films were useful in demonstrating a soft-tissue mass but, except in two instances, there was no evidence of bone destruction in the sphenoid By far the most significant x-ray examination was the stereoscopic verticomental, basal, or what we call axial views of the skull Twenty-four of our 26 patients had one or more stereo sets of axial films made during the course of their illness The initial findings are summarized in Table I

In 7 of the 24 initial axial examinations of the skull the findings were normal The remaining 17 showed varying degrees of destruction of bony stuctures at the base

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[1] From the Division of Roentgenology University of Chicago Presented before the Thirty-second Annual Meeting of the Radiological Society of North America Chicago, Ill Dec 1–5, 1946

[2] Assistant Professor of Roentgenology, University of Chicago

[3] Kellogg Fellow in Radiology University of Chicago

TABLE I BONE DESTRUCTION AS VISUALIZED IN AXIAL FILMS OF THE SKULL

Structure	Cases
Petrous apex	15
Greater wing of sphenoid, region of foramen ovale	13
Pterygoid plates	8
Basisphenoid	9
Basiocciput	3
Vomer	3
Antral wall	1

The structures most commonly involved were the petrous apex and the mesial portion of the greater wing of the sphenoid, especially about the foramen ovale Absorption of the basisphenoid and the pterygoid plates was observed with almost equal frequency In 3 cases the destruction extended posteriorly to involve most of the basiocciput and forward to involve the posterior edge of the vomer In only one case where the initial x-ray picture was normal did bony destruction appear at a later date

Presumably the loss of bony elements at the base of the skull is due to direct invasion by the neoplasm However, in view of the striking regeneration of the structures during roentgen irradiation, the question arose as to whether or not the changes might be due to osteomyelitis or pressure atrophy Osteomyelitis *per se* seems quite unlikely in view of almost complete lack of constitutional symptoms Pressure atrophy might explain part of the picture In one case (Case 6) which came to autopsy, tumor cells were found in the bony structures of the base of the skull Bach, Lederer, and Palevsky (7) also report one case with autopsy proof of extensive invasion of the base of the skull by nasopharyngeal tumor

PATHOLOGY

It is well to remember that the nasopharynx contains lymphoid tissue, serous and mucous glands, stratified squamous and stratified cylindrical ciliated epithelium Hence, a variety of tumors may arise in the vault of the nasopharynx All 26 of our patients had malignant lesions proved by one or more biopsies The distribution is illustrated in Table II Apparently our pathologists have been very critical in the diagnosis of lymphoepithelioma, since they did not use it even once This is quite in contrast to other reports

TABLE II BIOPSY FINDINGS

	Cases
Transitional-cell carcinoma	17
Squamous-cell carcinoma	7
Lymphosarcoma	1
Undifferentiated adenocarcinoma	1

In Nielsen's (5) series of 75 cases examined histologically, the most frequent tumor was lymphoepithelioma, occurring in 22 cases Squamous-cell carcinoma was next in incidence, accounting for 20 cases Stout (8) is in agreement with Nielsen as to the relative frequency of lymphoepithelioma, reporting 16 in a series of 57 patients Twenty-nine tumors in Stout's series were classified in the epithelioma group, most of them being undifferentiated Neither author used the term "transitional-cell" in his classification

X-RAY THERAPY

Although there was some individual variation in our method of treatment, the average patient received a depth dose of 5,000 r to the nasopharynx in 40 days, through three portals, two lateral and one anterior facial The lateral portals included the lateral facial and lateral cervical regions on each side, extending from just above eyebrow level to the supraclavicular region, covering an area about 10 × 20 cm The exposed larynx and auricles were protected with lead The object of so large a portal was to include not only the nasopharynx but also the regional lymph nodes These portals were usually decreased in size to 10 × 10 cm or 6 × 8 cm , to cover only the facial region, when the course was one-half to two-thirds completed, to reduce the reaction to treatment unless cervical nodes were the site of metastases and were responding poorly In that event, the large portal was used through the entire course The anterior facial portal usually measured 6 × 8 cm and extended

TABLE III SUMMARY OF CASES

Case	Age	Cervical Lymph Nodes Involved	Cranial Nerves Involved	Base of Skull Invaded	Length of Life
1	72	None	VI	Yes	Alive 10½ yr
2	25	Bilateral	None	Yes	7 yr
3	18	Unilateral	V, VI	Yes	Alive 5 yr
4	28	Bilateral	VI, X	Yes	Alive 8 yr
5	49	Unilateral	None	Yes	Alive 12 yr *
6	13	Unilateral	None	Yes	18 mo
7	59	Unilateral	III, V, VI		27 mo
8	50	None	V, VI, IX	Yes	Alive 10 yr
9	49	Bilateral	IX, X	No	3 mo †
10	25	Unilateral	V, IX, X	Yes	24 mo †
11	22	Bilateral	None	No	18 mo †
12	66	None	None	Yes	10 mo
13	53	Unilateral	None	Yes	12 mo
14	44	None	III, VI, V	Yes	6 mo
15	73	Unilateral	None		18 mo
16	44	Unilateral	None	No	36 mo
17	42	Unilateral	VI, IX, X	No	18 mo
18	42	Unilateral	None	Yes	36 mo
19	51	None	None	No	16 mo
20	41	Bilateral	None	Yes	30 mo
21	27	Unilateral	None	Yes	42 mo
22	49	Unilateral	None	Yes	24 mo
23	64	Unilateral	III V	Yes	24 mo
24	57	Unilateral	V, IX	Yes	15 mo
25	43	Unilateral	None	No	48 mo
26	55	Unilateral	None	Yes	Alive 36 mo

* Alive but with evidence of disease
† Alive when last seen but in such condition that survival much longer could not be expected.

in the mid-line from just above eyebrow level to the tip of the nose, the eyes and eyebrows being protected with lead

It was usually necessary to give skin doses of 11 to 12 × 300 rDo[4] to each of the lateral portals, and 4 to 5 × 300 rDo to the anterior facial region to obtain the desired depth dose The technical factors in most cases were 200 kv p , 20 ma , h v l 1 5 mm Cu, 80 cm focal-skin distance, 1 mm Cu plus 1 mm Al filtration This gave an intensity of approximately 12 r (air) per minute

RESULTS

Only 6 of our 26 patients are known to be living (Table III) Two have survived ten years, one has survived for twelve years but now has a recurrence (Case 5), one for eight years, one five years, and one for three years Similar results are reported from several other clinics The patient who has survived five years (Case 3) was treated for metastases to the femur three years ago, so that even at this late date, and in the absence of symptoms, we can hardly look upon him as being cured Three patients were alive with symptoms when last seen, but their condition was such that early demise could be expected

For the 17 known dead, the average period of survival was 23 months One (Case 2) lived seven years, but was never free of symptoms and signs, in spite of extensive radiation

CASE REPORTS

CASE 1 A 72-year old unemployed male reported to the Clinics complaining of severe, constant right frontal and occipital headaches of six months' duration, right nasal obstruction, right photophobia, diplopia, a buzzing in the right ear, and deafness for two months Physical examination revealed a granular reddish mass in the vault of the nasopharynx, partially obstructing both choanae, right papilledema, photophobia, external rectus palsy, no adenopathy Biopsy showed transitional cell carcinoma

An axial view of the skull (Fig 1, A), obtained in June 1936, just before irradiation, demonstrates extensive destruction of the right side of the base of the skull, *i e*, the mesial portion of the greater wing of the sphenoid, basisphenoid, petrous apex, pterygoid plates, posterior wall of the maxillary sinus, and the posterior margin of the vomer. Six months later there was partial regeneration

[4] rDo Skin dose with backscatter

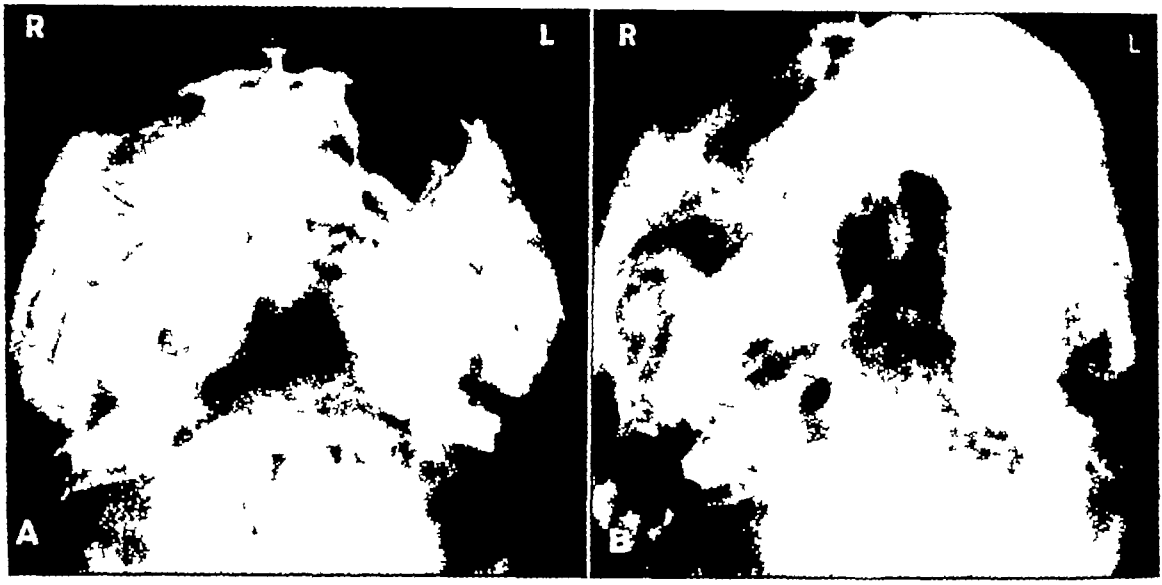

Fig 1 Case 1 A Before irradiation showing extensive destruction of the right side of the base of the skull Note especially the lack of definition of the foramen ovale and spinosum on the right as compared to their clear definition on the left, also the destruction of the inferolateral wall of the right maxillary sinus
B Taken ten years after treatment showing complete reconstruction of the basal structures The foramen ovale is now clearly visible and the inferolateral wall of the right maxillary sinus has been restored

Irradiation was accomplished by the periodicity method, *i e*, three series of treatments with intervals of two weeks between periods, with a depth dose of 5,400 r to the nasopharynx in fifty-eight days Other factors were as given in the text Ten years later (Fig 1, B) there is complete regeneration of bony structures at the base The patient is living and well, with no signs of disease

CASE 2 A twenty five-year-old housewife entered the hospital because of swelling of the neck of three months duration Physical examination revealed bilateral moderate enlargement of the upper cervical lymph nodes, a small mass in the vault of the nasopharynx, and retraction of both ear drums Biopsy revealed transitional-cell carcinoma

A pre irradiation axial view of the skull (November 1938) demonstrated destruction of the basisphenoid mesial portion of the right greater wing of the sphenoid, right petrous apex, and right pterygoid plates Six months after the first course of irradiation there was partial reconstruction of the base One year after the onset of symptoms cranial nerve signs developed, *i e*, involvement of the sixth, tenth and twelfth cranial nerves Four subsequent courses of irradiation were given, to a total depth dose of 12,300 r, in a period of three years and eleven months (factors as given in the text) The patient was almost never free of symptoms or signs during this period She died in October 1943, six years after the onset of symptoms

CASE 3 An 18-year old school boy was admitted because of deafness of the right ear for eight months and swelling of the right cheek for six months He had lost 25 pounds in weight He had been under the care of his physician for three months without a diagnosis Physical examination revealed a mass in the vault of the nasopharynx, marked trismus, redness and retraction of the right ear drum, right fifth and sixth cranial nerve palsies Biopsy was done, resulting in a diagnosis of transitional-cell carcinoma

An axial view of the skull (Fig 2, A), before irradiation, revealed destruction of the right pterygoid plates and the right petrous apex.

In a period of forty-four days a depth dose of 5,400 r was given to the mass in the nasopharynx (method and factors as described in text)

On a second admission, ten months later, the patient had severe low back pain and pain in the right knee Lumbosacral films were suggestive of a sclerosing lesion in the promontory of the sacrum and a second one in the right ilium Films of the right knee (Fig 2, B) revealed a 3-cm osteolytic lesion of the lower end of the femur with a definite periosteal reaction

The patient was given about 1,600 r in the depth to the lesions in the pelvis and femur Symptoms were relieved and there was a gain in weight. Films of the right knee six months after irradiation showed almost complete filling in of the osteolytic process and reorganization of the periosteal reaction Films of the lumbosacral spine showed no change since the previous examination According to the statement of relatives and friends, the patient is now alive and well, working in the merchant marine, three years after the last x-ray treatment to the metastatic lesions

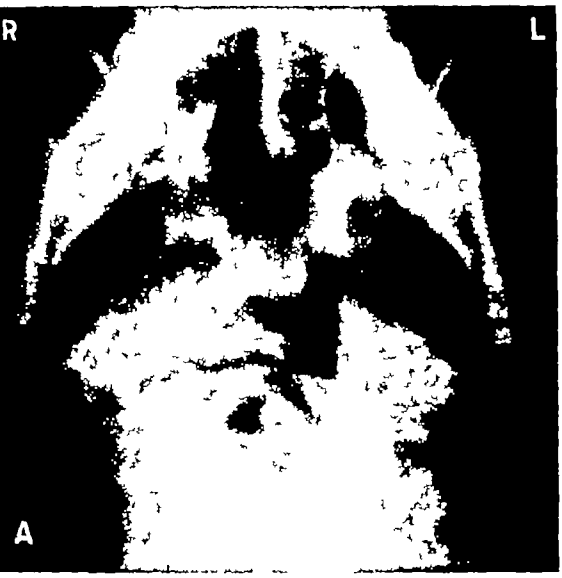

FIG 2, A CASE 3 Axial view of skull, showing minimal bone absorption about the right petrous apex and some destruction of the right pterygoid plates

CASE 4 A 28 year-old white man was admitted, complaining of swelling of the right side of the neck, right sided headaches, and discharging right ear for the past six months, and double vision with crossing of the right eye, regurgitation of food, and nasal voice for four months Physical examination revealed paralysis of the right external rectus (sixth nerve), paralysis of the right half of the soft palate (tenth nerve), a mass in right fossa of Rosenmüller, and large nodes in the right side of the neck, involving the anterior and posterior chains Biopsy proved the tumor to be a transitional cell carcinoma

An axial film of the skull (Fig 3) demonstrates minimal bone absorption in the region of the right foramina lacerum and ovale

The patient received a depth dose of 5,090 r in a period of fifty-six days (factors as in the text) He rapidly improved and was alive and well eight years later Repeated axial films of the skull during this period failed to show any change over the initial examination, *i e*, the bone absorption about the foramina lacerum and ovale

CASE 5 A 49-year-old white male was admitted September 1934, complaining of pain and swelling in the left side of the neck for four months Physical examination revealed a tumor involving the left side of the mesopharynx and nasopharynx and a hard, fixed mass in the left side of the neck Biopsy of a cervical lymph node showed metastatic transitional-cell carcinoma

The patient received 4,860 r to the pharyngeal mass and a 4,000 r tumor dose to the involved cervical nodes in forty-nine days (factors as in the text) He became asymptomatic and the masses in the nasopharynx and neck disappeared one week after treatment was completed

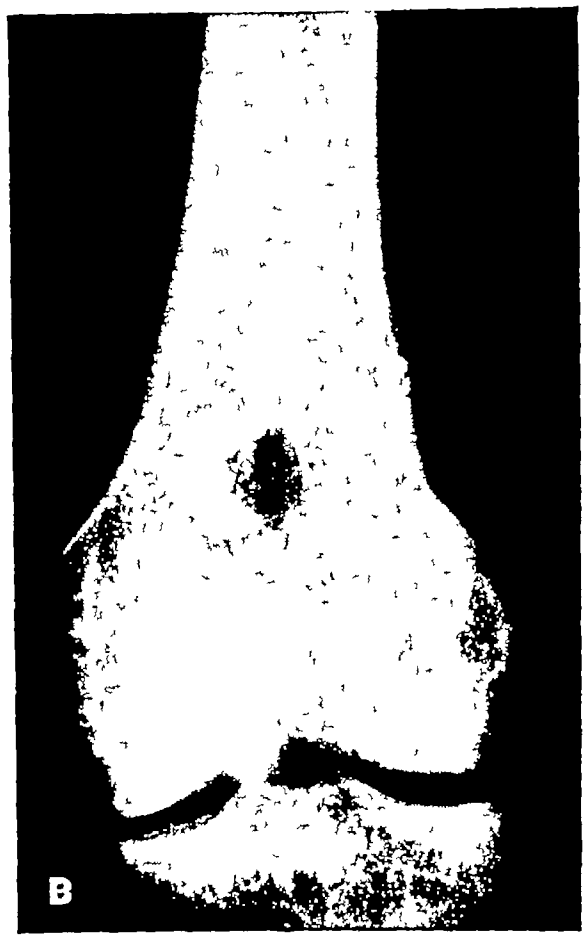

FIG 2, B CASE 3 Osteolytic lesion in the distal right femur with associated periosteal reaction Presumably this was a metastatic focus It responded to irradiation

In June 1943, an axial view of the skull was negative There was no evidence of recurrence of the tumor

The patient was readmitted in July 1946, twelve years after his first admission, complaining of deafness in the right ear for four months Examination showed a mass in the right nasopharynx, involving the right half of the hard and soft palate Biopsy of this mass again revealed a transitional-cell carcinoma

An axial view of the skull, obtained July 29, 1946, before irradiation, showed bone absorption in the region of the right foramen ovale and right petrous apex

The patient was given another course of x-ray therapy, receiving 6,240 r to the nasopharynx in forty-five days The mass decreased in size following this treatment but did not completely disappear, indicating that the lesion was not yet under control

CASE 6 A 13-year-old colored schoolboy was admitted to the Ear, Nose, and Throat Clinic, complaining of the following symptoms for the past six

months stiffness of the neck, inability to completely open the mouth, swelling beneath the ramus of the right mandible, roaring and impairment of hearing in the right ear, and spitting up of dark red blood Physical examination showed marked trismus, limitation of motion of the neck, a firm swelling under the right mandible, and a small tumor in the region of the right fossa of Rosenmüller Biopsy of this lesion showed a squamous-cell carcinoma

A film of the base of the skull (Fig 4, A) revealed bone destruction on the right side, involving the medial third of the petrous pyramid, the lateral portion of the body of the sphenoid and the basiocciput, the greater wing of the sphenoid, and the pterygoid process

tender nodes on the left side of the neck, stiffness of the neck, trismus, and a nasopharyngeal mass There were also tenderness and swelling in the right iliac region Films of the pelvis were negative.

The symptoms became progressively severe and the patient expired approximately eighteen months after the onset of his illness Autopsy revealed a massive squamous-cell carcinoma in the superior nasopharynx with direct extension into the base of the skull There was destruction of the medial half of the right and the tip of the left petrous pyramid with extensive tumor cell invasion of the basiocciput and the body of the sphenoid bone which had broken through into the sphenoid sinus The internal cranial periosteum everywhere remained

Fig 3 Case 4 Basal view of skull demonstrating bone destruction in the region of the right foramen ovale.

X-ray therapy was given—6,918 r to the nasopharyngeal tumor over a period of forty days through three portals, right and left cervicofacial and one occipital

For several months after treatment the patient showed clinical improvement An axial view of the skull, taken four months after the initial examination (Fig 4, B), revealed some decrease in the size of the cavity in the right base. Thereafter, however, there was a recurrence of symptoms, with a slow downhill course. In addition, the patient suffered from severe headache, pain and discharge from the right ear, pain in the right hip, vomiting, and weight loss Physical examination showed many hard,

intact, so that there was no actual invasion of the brain

SUMMARY

Twenty-six proved cases of malignant neoplasms of the nasopharynx are reviewed Transitional-cell carcinoma was the commonest lesion

Cervical lymphadenopathy was present in the majority of the patients on the initial examination

Eighteen of the 24 patients examined by

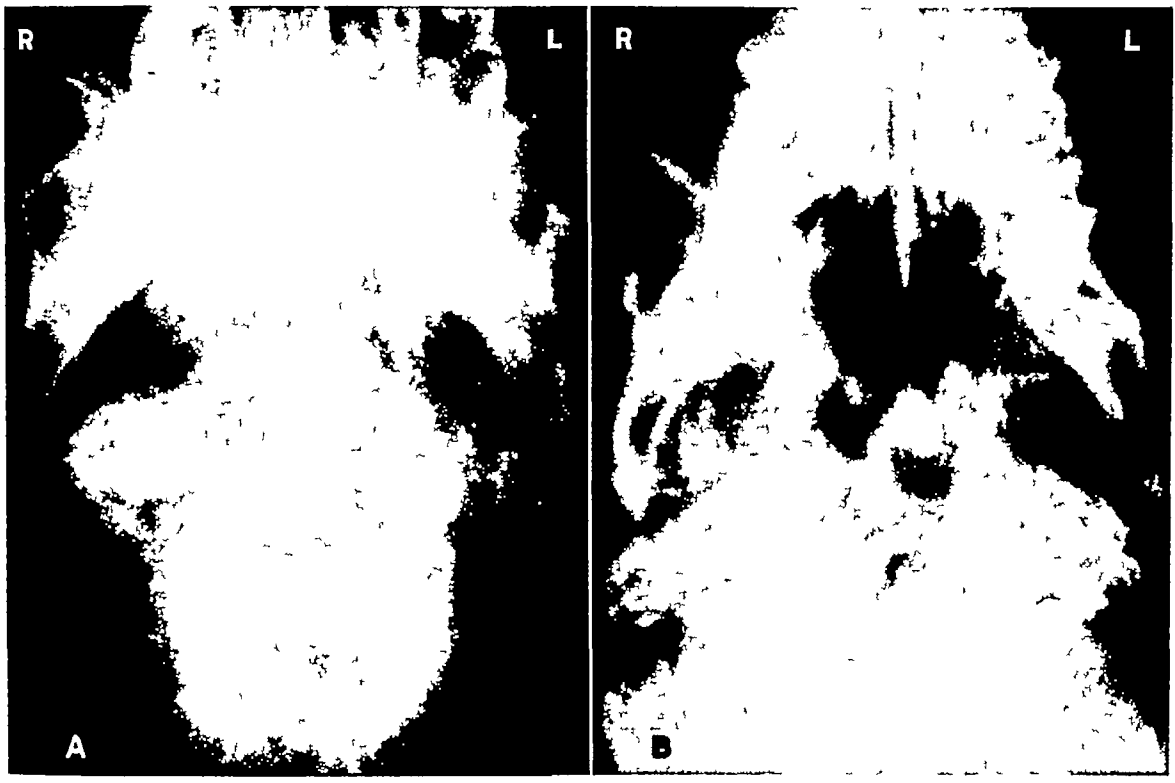

Fig 4 Case 6 A Pre-irradiation axial view of skull showing destruction of the right petrous apex the right lateral wall of the body of the sphenoid and basiocciput and the basal portion of the right greater wing of the sphenoid The right pterygoid process was also involved, but this is not apparent in the reproduction
B View made four months after the initial examination and three months after the completion of x-ray therapy, showing some decrease in the size of the cavity at the right base At autopsy six months later, tumor cells were found invading and destroying the bony structures at the base of the skull corresponding to the region of apparent destruction demonstrated by the x ray examination

axial roentgenograms of the skull showed bone destruction, most frequently in the region of the petrous apex and foramen ovale

External x-ray irradiation was used in all cases as the only treatment, 5,000 r in forty days being the usual tumor dose

Seventeen patients are now dead, the average survival period from the time of treatment being twenty-three months Of those still living, 4 are free of disease five years or longer, 1 is well after three years, 1 was apparently well for twelve years and now has a local recurrence, the remaining 3 patients were alive when last seen but are not expected to survive

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DISCUSSION

Fred J Hodges, M D (Ann Arbor, Mich) It is a great pleasure to open the discussion on so workmanlike a paper as the one we have just heard There is little that I can add, except perhaps to emphasize one or two points which are in striking agreement with the experience we have had in our hospital

Dr Meyer did not mention the matter of age incidence, I think, except to point out that one of his patients was a boy of 13 We have come to look upon this particular disease as one which is to be expected in younger individuals It is not at all uncommon in the third decade, and yet it is not to be forgotten that the disease certainly can be seen in the aged and the middle-aged as well

We are in agreement with the authors of this paper regarding tumor type, at least in our experience I cannot remember that our pathologist has ever reported "lymphoepithelioma"

I would also like to point out that we are in complete agreement with regard to the extreme difficulty of identifying the true nature of this disease in a great many instances It is not at all uncommon to find this lesion in a late stage of advancement Often the presenting sign is metastasis to cervical nodes, and intensive search for the primary site must be instituted Unless one is aware that it may be situated very high in the nasopharynx, the primary lesion will seldom be discovered

The need for biopsy is great, and it is necessary to attempt adequate and careful treatment even in the face of what appears to be overwhelmingly far-advanced progress of the disease We have had patients who appeared to be hopelessly beyond the assistance of radiation methods who responded remarkably well to the same general type of treatment which has been so well outlined We have been surprised to find what excellent palliative results can, on occasion, be obtained

There is only one other point I would like to mention, and that is to call your attention to the axis view of the skull and to urge you to adopt its use It is quite impossible to detect or to outline or recognize the extent of bone destruction that malignant tumors arising high in the nasopharynx are prone to produce unless one can get an adequate view of the floor of the skull Anteroposterior and lateral projections simply will not tell the true story

The axial view, whether made with the patient's head sharply hyperextended and the beam directed through the rami of the mandible, or with the mandible resting close to the film and the beam coming in through the vertex, is required The very best possible way to see the extent or the location of the damage is to use stereoscopic technic Until one has seen in three dimensions the enormous destruction which oftentimes occurs, it is difficult to appreciate how far the disease may have progressed

This is an extremely interesting type of neoplasia I agree with the authors when they say it is fortunate it does not occur very frequently It can present an extremely difficult problem unless the approach which has been outlined for you is intelligently employed

J E Whiteleather, M D (Memphis, Tenn) I have been interested in this problem for a long time It is perfectly amazing to me how many such cases there are I can remember hardly a time in the last ten years that we have not had at least one patient under treatment Another amazing thing is the fact that relatively few patients are referred by nose and throat specialists Most of our patients have been discovered because of diagnostic problems either in the field of general surgery and medicine or neurosurgery

One thing we have discovered—and I think it is worth pointing out—is that it is often difficult to see the primary lesion even with nodes present in the neck or with neurologic distribution of pain and other evidences of cranial nerve involvement. The primary lesion may still remain invisible We have found two ways of uncovering it. One is very careful and repeated nasopharyngeal examination and the other is a deep punch biopsy in the region around or in the fossa of Rosenmüller After radiation treatment is started, a daily examination of the patient often demonstrates a slight color difference between the lesion and the adjacent membrane, due to a difference in radiation reaction

There is another thing I wish to mention in regard to the lesions at the base of the skull Several years ago, when we made base studies of these patients, I was sure that we saw destructive changes Then we made a large number of normal studies, for other purposes, and as a result I am not so certain, for there are a great many variations in density in the sphenoid wings, and in the size, appearance, and location of the foramina I am rather hard put now to determine what is normal and what is abnormal

One used to be considerably concerned as to whether these were transitional-cell carcinomas or so-called lymphoepitheliomas We had a young man, my prize patient, who was treated while he was in early high school He seemed to recover, went to college, graduated, and then had a recurrence A second biopsy was done at the exact site of the primary lesion The earlier biopsy had been classified as transitional cell carcinoma, the second could not be differentiated from what is called lymphoepithelioma Both were from the same spot, in the same patient, yet the difference in the appearance of the cells was quite marked

Ralph R Meyer, M D (*closing*) I am grateful for these excellent discussions Even though a cure is not effected, almost always the patient will receive good palliation Dr Hodges stated that patients who appear to have very extensive and hopeless disease still make an amazingly good response to x-ray therapy That has also been our experience

Good response to x-ray therapy in advanced disease is well illustrated by our first case The initial axial examination of the skull showed marked destruction of one side of the base, even extending upward and involving the lateral wall of the antrum For ten years the patient failed to return We therefore assumed that he was dead To our surprise, he recently appeared, at the age of 82 He was asymptomatic except for mild infirmities common to his years Examination failed to reveal any evidence of disease

Although carcinoma of the nasopharynx comes to us in an advanced stage, we can obtain good palliation and prolongation of life in almost all cases, and in about 20 per cent a cure can be effected by radiotherapy

SUMARIO

Observaciones en el Carcinoma Nasofaríngeo

Repásanse 26 casos comprobados de neoplasia maligna de la nasofaringe El carcinoma de células de transición representó la lesión más frecuente En la mayoría de los enfermos descubrióse linfadenopatía cervical en el primer examen

Dieciocho de los 24 enfermos estudiados con radiografías axiles del cráneo revelaron osteonecrosis, con mayor frecuencia en la región del ápice del petroso y el agujero oval

Como único tratamiento en todos los casos se empleó la irradiación externa con rayos X, siendo la dosis habitual por tumor 5,000 r en 40 días

Diecisiete enfermos ya han muerto, promediando 23 meses el período de sobrevivencia desde la fecha del tratamiento De los vivos todavía, 4 han estado sin signos de enfermedad cinco años o más, 1 se halla bien al cabo de tres años, 1 estuvo aparentemente bien por espacio de 12 años, pero tiene ahora una recurrencia local, los otros 3 se hallaban vivos cuando se les observó la última vez pero no se espera que sobrevivan

Diverticulitis with Abscess Formation and Vaginal Fistula[1]

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DIVERTICULOSIS is a common finding in the routine examination of the colon Of 31,838 patients who underwent roentgenologic examination of the large intestine at the Mayo Clinic, 5 7 per cent had diverticulosis (1) It is stated (2, 6) that there will be 65 cases for every 1,000 examinations, and that about 15 per cent of these will present complications such as diverticulitis with spasm, diverticulitis with infiltration, and diverticulitis with perforation Diverticulitis with perforation occurs in about 3 per cent of the cases of diverticulosis and may be either acute or chronic The chronic cases progress as follows (*a*) Perforation into the bowel with discharge of pus, (*b*) perforation into the surrounding tissues, with localization, (*c*) perforation into the bladder, or (*d*) perforation through the pelvic floor with the formation of an ischiorectal abscess or fistula in ano Rare cases of perforation into the ureter and splenic flexure have also been reported

Recently two cases with diverticulitis, abscess formation, and perforation through the posterior cul de sac have been observed The presenting symptom in both cases was a purulent vaginal discharge

CASE I A 55-year-old female was admitted, complaining of a purulent vaginal discharge of one week s duration Her earlier history was essentially negative except for occasional pains in the left lower quadrant during the past five years These pains were relieved by a bowel movement and were more severe when the patient was constipated They were not, however, of sufficient severity to warrant her consulting a physician At times she had a fever of 102° F during the episodes of pain Menstruation had begun at the age of thirteen, the periods were always regular and lasted four days The patient did not recall ever having had any unusual discharge Her family history was essentially negative She had one child, aged twenty-two

The present illness had started two weeks before admission to the hospital with vague pains in the left lower quadrant. One week later, a profuse purulent discharge occurred from the vagina, occasionally with a foul odor The discharge was so profuse that it required frequent changes of pads In addition, the left lower quadrant pain was more severe

The patient was well developed and well nourished and did not appear acutely ill. Temperature was 100° F , pulse 90, blood pressure 140/80 Abdominal examination disclosed considerable tenderness in the left lower quadrant, with some rebound tenderness There was a suggestion of a mass about the size of a grapefruit in this area. Pelvic examination showed the uterus to be irregular and enlarged to the size of a three months' gestation by multiple fibroids The cervix was smooth A tender mass could be palpated in the region of the left adnexa The right adnexa could not be felt A considerable amount of purulent material was observed in the vagina. In addition, a small perforation was found in the posterior cul de sac, from which the purulent material was seen exuding

The patient was admitted to the Gynecologic Service with a tentative diagnosis of fibroid uterus and pyosalpinx on the left side The possibility of diverticulitis with perforation also was entertained Smear and culture of the discharge revealed *B coli* and no evidence of gonococci Sulfadiazine was given and at the end of three days the discharge had considerably diminished. The mass in the left lower quadrant was now approximately half its original size

Because of the previous colonic symptoms, a barium enema study was performed This revealed an area of constriction in the region of the rectosigmoid measuring about 4 cm in length There appeared to be a filling defect on its medial aspect. Also, during the fluoroscopic examination, barium appeared to issue from the large bowel into a mass immediately adjacent to the sigmoid (Fig 1) On the evacuation film many diverticula were noted in the area of constriction and in the upper portion of the rectum (Fig 2) The findings were thought to be due to a diverticulitis with perforation On one of the films the appearance suggested that the barium was passing to the posterior cul de sac

Improvement continued under medical therapy

[1] From the Department of Radiology and Gynecology, Mount Sinai Hospital New York, N Y Accepted for publication in February 1947

Fig 1 Case 1 A barium enema examination reveals an area of constriction about 4 cm in length in the region of the rectosigmoid There appears to be a mass on the medial aspect of the rectosigmoid in this region Barium is also seen outside of the bowel in this area (arrow)

The discharge completely disappeared and the mass could no longer be felt The opening in the posterior cul de sac was still present at the time of the patient s discharge

CASE II A 46-year old female was admitted, complaining of a purulent vaginal discharge of two weeks' duration and severe pain in the left side of the abdomen Her past history included a hysterectomy, at the age of forty, for multiple fibromyomata She had had an appendectomy at the age of fourteen Otherwise the past history was essentially negative

The present illness began four weeks before admission to the hospital, with intermittent pains in the left lower quadrant accompanied by fever, sometimes reaching 103° F, and occasional chills Two days before admission to the hospital a profuse purulent discharge was noted, which sometimes had a foul odor

The patient appeared well developed and well nourished, but ill Temperature was 102° F, pulse 90, blood pressure 120/70 Abdominal examination disclosed considerable tenderness in the left lower quadrant, with a mass the size of an orange in this area Pelvic examination revealed marked tenderness in the left adnexal region The stump of the cervix was felt A

Fig 2 Case 1 A post-evacuation film shows numerous diverticula throughout the upper portion of rectum, rectosigmoid and sigmoid The barium is again seen extrinsic to the bowel (arrow)

considerable amount of purulent material was observed in the vagina A small perforation was discovered in the posterior cul de sac

The patient was admitted to the hospital with the tentative diagnosis of diverticulitis with abscess formation Smear and culture of the purulent discharge revealed numerous *B coli*, with no evidence of gonococci Sulfadiazine and penicillin were given, and at the end of one week the discharge had markedly diminished The mass in the left lower quadrant could no longer be palpated

Barium enema examination revealed numerous diverticula distributed throughout the rectosigmoid, sigmoid, and descending colon, with the characteristic "saw-tooth" appearance of the bowel in the region of the rectosigmoid Following the barium enema examination, the course was quite stormy, with temperature ranging from 100 to 104° F Treatment by infusions, transfusions, Levin tube, and continued sulfadiazine and penicillin resulted in subsidence of the symptoms after a month

COMMENT

The differentiation of gynecological disorders and diverticulitis or other lesions of the bowel may be very difficult In many instances, exploration for tubo-ovarian dis-

ease discloses diverticulitis The indurated and inflamed bowel prolapsed into the cul de sac may completely simulate a gynecological disorder such as ovarian tumor, pyosalpinx, or posteriorly placed myomatous masses

Fistula formation secondary to diverticulitis is not uncommon The urinary bladder, however, is the usual site of such fistulae, though fistulous communication with adjacent viscera, as the ureter, splenic flexure, and stomach has been reported Ischiorectal abscesses and fistula in ano are not unusual

Fistula formation in females is less common than in males probably because of the protection of the uterus and fallopian tubes This is especially true of perforation into the urinary bladder or through the pelvic floor In one of our two cases a previous hysterectomy had been performed

Although perforation through the cul de sac is extremely rare as a complication of diverticulitis, it has been reported by Crohn (3) in regional ileitis His description of this complication is readily applicable to the above cases and is as follows

"Infectious pus and material escaping from the porous terminal loop of ileum seeps downward, infecting the pelvic peritoneum and retroperitoneal fat, a rows through the pelvic fascia by a i tract which tends downward In male the fistulous tract may trav rectovaginal septum and make it the perineum, vagina, the rectum rectovaginal fistula "

CONCLUSION

Two cases of diverticulitis, abs mation, and perforation through terior cul de sac are presented of perforation is most unusual

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SUMARIO

Diverticulitis con Absceso y Fistula Vaginal

Las fistulas secundarias a diverticulitis no tienen nada de raro La vejiga urinaria constituye el asiento habitual de las mismas, pero se han comunicado casos de comunicación con otras vísceras, como el uréter, la flexura esplénica y el estómago La perforación en el fond lo más extraño

Preséntanse ahora dos c el síntoma principal con vaginal purulento con dol izquierda y fiebre

Bronchography in Asthmatic Patients, with the Aid of Adrenalin[1]

BERNARD S EPSTEIN, M D , JEROME SHERMAN, M D , and EUGENE E WALZER, M.D
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BRONCHOGRAPHY becomes an important diagnostic procedure in asthmatic patients when the possibility of a coexistent bronchiectasis must be investigated In our experience this procedure has proved difficult, and adequate visualization often has not been obtained because of inability of the patient to co-operate An effort was made, therefore, to modify the technic so as to diminish the attendant discomfort

On the assumption that part of the difficulty might be due to edema, spasm, or secretions within the bronchial tree, a preliminary period of dehydration was instituted This proved to be of no value Dehydration with the subcutaneous administration of 0 5 to 1 0 c c of a 1 1,000 solution of adrenalin immediately before the intratracheal instillation of iodized oil was then tried with much better results It soon became evident, however, that dehydration was unnecessary, and that the subcutaneous injection of adrenalin was sufficient to enable most patients to cooperate comfortably Adequate bronchographic visualization was thus obtained where it was impossible to proceed by the usual technics

Fluoroscopic examination during the instillation of iodized oil without preliminary adrenalin disclosed a characteristic pattern As the oil entered the trachea and main bronchi, a spasm of coughing followed, during which the oil could be seen oscillating both in the main bronchi and their primary subdivisions This started as soon as the oil came in contact with the carina Attempts to obtain spot roentgenograms were uniformly unsuccessful It was almost impossible for the most willing and co-operative patient to control the cough, and within a short time almost all of the oil was either expectorated or swallowed The resultant bronchograms were unsatisfactory

The same patients were then examined with the aid of subcutaneous adrenalin. The improvement observed in their reaction was striking Fluoroscopically the secondary bronchi could be seen to begin relaxing about thirty seconds after the adrenalin injection The oil then entered these structures in short squirts, particularly during the inspiratory phase of respiration Breathing was easier, and cough was markedly reduced Within a few minutes the lower lobe bronchi could be satisfactorily outlined and bronchograms made without haste

Our present technic is as follows Breakfast is omitted, and ten minutes before examination 2 c c of sodium phenobarbital (120 mg) is injected intramuscularly The posterior pharyngeal wall is then sprayed with a small amount of 2 per cent butyn solution At this time it is advisable to wait about ten minutes to make sure that no sensitivity to butyn exists Anesthesia of the throat is then completed When the swallowing reflex is lost, 2 c c of butyn solution is injected forcibly toward the back of the throat while the patient takes a deep breath, to anesthetize the carina A catheter is inserted into a nostril and passed under fluoroscopic guidance until its tip lies just above the larynx. About 3 c c of iodized oil is injected, and as soon as this enters the trachea, 0 5 to 1 0 c c of adrenalin is injected subcutaneously The rest of the oil is injected under fluoroscopic control and the patient is so positioned that the desired views are obtained No food or water is permitted for three hours after the procedure

[1] From the Department of Radiology (M G Wasch, M D) and the Department of Allergy (M Walzer M D) The Jewish Hospital of Brooklyn Brooklyn N Y

Sixteen patients, varying in age from thirty-five to sixty-five years, of whom 11 were men, were selected for study because of cough and expectoration In 8, two or three attempts were made without preliminary adrenalin and in the others there was but one such attempt Success was attained in 15 after adrenalin administration, while all were unsuccessful without the aid of adrenalin The resultant bronchograms were considered good in 12 and fair in 3 cases All showed radiologic evidence of bronchiectasis, confirming the clinical impressions

COMMENT

Although the administration of adrenalin during intratracheal instillation of iodized oil has been mentioned by others, we have been unable to find an account of any study specifically directed toward ascertaining its value in easing the procedure In 1933 Christopherson (1) reported that during an asthmatic episode the bronchioles were constricted so that lipiodol could not enter Between attacks, or after the injection of 10 minims of 1 1,000 solution of adrenalin, the characteristic network of smaller bronchioles became apparent Balyeat and Seyler (2) recommended epinephrine to control wheezing in asthmatic patients prior to the introduction of iodized oil for therapeutic purposes Later Balyeat, Seyler, and Shoemaker (3) used 6 to 10 minims of adrenalin preceding bronchography for diagnostic or therapeutic purposes in patients with asthma who were coughing or wheezing They believed that adrenalin decreased edema of the bronchial tubes, permitting the patient to expectorate viscid sputum, thereby allowing the oil to enter the secondary bronchi Anderson (4) recommended that iodized oil be administered therapeutically for asthma between attacks However, if oil must be given during asthmatic episodes, adrenalin was suggested before instillation to relieve bronchial spasm and edema We have noted that these patients do not as a rule expectorate very much after adrenalin injection and that the bronchial tubes can be seen fluoroscopically to open and fill with oil in patients who do not cough at all during the procedure

But one negative report on the value of epinephrine in bronchography in asthma was found (Rigler and Koucky, 5)

SUMMARY

Results indicate that the hypodermic injection of adrenalin before the intratracheal instillation of iodized oil for bronchography in asthmatic patients greatly facilitates the performance of the examination Good results could thus be obtained when the usual technics were unsuccessful

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SUMARIO

La Adrenalina como Auxiliar en la Broncografía en los Asmáticos

Los resultados obtenidos en una serie de 16 enfermos indican que la inyección hipodermica de adrenalina antes de la instilación intratraqueal de aceite yodado para la broncografía en los asmáticos facilita considerablemente la ejecución del examen, permitiendo llevarlo a cabo con éxito después de fracasar las técnicas corrientes

EDITORIAL

The National Campaign for a Total Population Chest Survey

Statement of Policy
to the Members of the Radiological Society of North America, Inc

The Radiological Society of North America was recently notified regarding a National Advertising Campaign urging the people of this country to have chest x-rays The preliminary correspondence was published as an Editorial in the November 1947 issue of RADIOLOGY The Board of Directors of the Society considered this matter at its recent meeting, in December 1947, and wishes to notify the membership as to its official attitude on this question The Board believes that

(1) The public is entitled to the maximum possible reliability in any proposed mass or individual x-ray examinations The public should be clearly informed concerning the inherent limitations of the method

(2) Only qualified personnel should be used to supervise the technical procedures and make the interpretations (Each county medical society should be requested to designate a list of qualified local or regional personnel for x-ray survey work in that district)

(3) The organizations sponsoring the 1948 advertising campaign should secure approval by state and county medical society units before conducting extensive programs or setting up any survey center in connection with this scheme

(4) A clear and practical procedure for the handling of persons who are found to have abnormal shadows should be outlined by the sponsoring organizations, and *suitable local methods should be delineated for regular medical examinations*, sputum and allied studies, plus arrangements for treatment and follow-up

(5) All other necessary steps should be taken to assure as far as possible that the survey study is done with thoroughness and without prejudice to the employability or insurability of persons with minimal shadows of unestablished origin

The Thirty-Third Annual Meeting

The Thirty-third Annual Meeting of the Radiological Society of North America, held at the Statler Hotel in Boston, Mass , from Nov 30 to Dec 5, 1947, was in many respects a record breaker The registration, 1,750, exceeded by far that at any previous meeting and went beyond the expectations of those in charge of the arrangements This remarkable registration is the best tribute to the Committees on Program, Refresher Courses, and Exhibits

Our friends and neighbors to the north and south were generous in their representation Canada sent fifty members and guests in spite of exchange restrictions Mexico sent six, five from Mexico City and one from Guadalajara Havana had three

envoys There was one each from San Salvador, Puerto Rico, and Brazil, making a total of twelve from Central and South America We were honored, also, in having guests to the number of eleven from more distant countries There were three from Poland and one each from Czechoslovakia, Belgium, Denmark, Greece, Spain, India, China, and Iraq

The formal program opened Monday morning with warm words of welcome from Dr Edward P Bagg, President of the Massachusetts Medical Society As is customary, the first paper was the Presidential Address, "Radiology and the Practice of Medicine," by Dr Frederick W O'Brien The remainder of the morning was filled with a symposium "Socialized Medicine and America" Although these papers were not scientific in the sense that the remainder of the program was, they comprised one of the most important sessions of the meeting

The Monday afternoon diagnostic section was devoted to important papers on the digestive tract, and the therapy section to the newest tools of radiology (which most of us have not as yet the faintest idea how to use)—radioactive isotopes, neutrons, and very high voltage radiation

The number of papers was so large that until Friday afternoon both morning and afternoon sessions were divided into diagnostic and therapeutic sections Even then there were twenty-seven papers to be read by title

On Tuesday, both diagnostic sections were given over to diseases of the lungs In the therapy sections attention was given to lymphoid tumors, cancer of the lip, and cancer of the larynx

The Society was honored on Tuesday evening in having Dr Douglas Quick as the Carman lecturer His subject was "Therapeutic Radiology" Because of Dr Quick's wide experience and distinguished position, no one is more qualified than he to speak on this subject and the growing pains incident to the fission of our specialty into twins, one therapeutic and the other diagnostic

In the diagnostic sections on Wednesday the children and the circulatory system had a field day, with a symposium on pediatric roentgenology in the morning and papers on arteriography, venography, angiocardiography, and circulatory surgery in the afternoon The therapists were more than content with a fine symposium in the morning on radioactive iodine and an afternoon devoted to the treatment of carcinoma of the cervix

Thursday morning was given over to the nasal sinuses and the central nervous system, and the afternoon to various aspects of the bones and joints on the diagnostic side, while the therapy sessions covered multiple myeloma, breast cancer, some brain tumors, infections, thrombophlebitis, hemangiomas, and asthma

At the Executive Session on Thursday, Dr Edgar P McNamee was chosen President-Elect, Dr Charles H Heacock, First Vice-President, Dr Kenneth S Davis, Second Vice-President, Dr Barton R Young, Third Vice-President, Dr Donald S Childs, Secretary-Treasurer, Dr Howard P Doub, Librarian, and Dr Ira H Lockwood, member of the Board of Directors

Thursday evening started off with a whoop at a delightful cocktail party given by the New England Roentgen Ray Society, for which your reporter is empowered by the guests to say "Thank you, we had a very nice time indeed" This was followed by a delicious banquet, the installation of officers, an interesting movie, and dancing

Precedent was broken this year and two Gold Medals were awarded for eminent service to Radiology One medal went to Dr Gioacchino Failla, the other to Dr Douglas Quick The attainments of these two scientists and gentlemen are well enough known so they need not be chronicled here Of equal importance with their great scientific accomplishments has been the invaluable influence they have exerted because of personal qualifications which have converted the profession into willing and grateful followers

On Friday the diagnostic subjects covered were lesions of the small and large bowel, the biliary tract, various joint diseases, and a subject close to all of us, a study of the hands of radiologists Therapy was widely reviewed by papers on carcinoma of the vulva and urethra and of the fundus, testicular tumors, rotation and multiple port technics, and supervoltage and contact irradiation

Everything about this meeting deserves praise It is not difficult to place the responsibility for such success To Dr O'Brien first go our heartiest thanks The apparent effortlessness with which the meeting proceeded indicated many hours of hard work and forethought The selection and the arrangement of the program were exemplary Secondly, we would express our gratitude to the radiologists, and no doubt to some non-radiological physicians, of Boston and New England, for their fine hospitality They obviously went out of their way to make the meeting a success Individual thanks are deserved, but space requires that we appoint the chairmen of the local committees as proxies to receive these Hugh Hare and his Executive Committee, Edward B D Neuhauser and the Scientific Sessions Committee, George Levene and the General Entertainment Committee, Harvey Morrison and the Registration and Housing Committee, Joseph Marks and the Commercial Exhibits, Robert Vance and the Refresher Courses, and Merrill Sosman and the Scientific Exhibits Committee Thirdly, to the other officials of the Society, the Board of Directors, and Dr Childs for the important but not always conspicuous part they play in making the Annual Meeting a scientific and a social success, many thanks

Last, but far from least, orchids to Mrs Hare and the Ladies Entertainment Committee for an exceptionally fine program

The high quality of the papers, the refresher courses, the scientific exhibits, the many interesting and new things seen in the commercial exhibits, and the gracious hospitality which solved the many problems of the unusually large registration will long be remembered

SYDNEY J HAWLEY, M D

The Refresher Courses

The Refresher Courses for the 1947 meeting at Boston began Sunday afternoon, Nov 30, with Dr Leo Rigler in the diagnostic section on acute abdominal diseases and Dr Juan A del Regato in the therapy division on carcinoma of the cervix and endometrium Both of these courses had a very large attendance and aroused much favorable comment Sunday evening brought two sessions—the ever-popular "Film Reading," with Ringmaster Prof Merrill Sosman presiding over the uneasy but valiantly striving Profs John Camp, Harry Garland, Fred Hodges, and Leo Rigler While this was going on, Prof Robert Newell was conducting a quiz section "Therapy Information Please," assisted by Drs B V A Low-Beer, Edith Quimby, Milton Friedman, and Lowell Goin Bob Newell came armed with a lot of prepared questions, but the audience had too many questions of its own to let him use his

Continuing on therapy, Dr Lowell Goin discussed the use of contact therapy, Dr Bernard Widmann, treatment of cancer of the skin, Dr Arthur W Erskine, transvaginal irradiation, Dr Theodore P Eberhard, treatment of carcinoma of the breast, Dr Maurice Lenz, cancer of the larynx and pharynx, Dr James A Corscaden, benign lesions of the female genital tract, Dr Hugh Hare, lymphoid tumors

Physicists G Failla, Edith Quimby, and J L Weatherwax ably contributed three lectures on measurement of radioactive isotopes, radium dosage, and x-ray dosage

In the diagnostic division, Dr Fred Hodges opened Monday morning with a course on urinary tract disease This was

repeated the following day, giving the men two opportunities to take this course, one solution to the problem of overlapping courses The committee wishes it could do more about this, but can see no solution to trying to see all phases of a circus at one time

Dr L R Sante again discussed the pneumonias Dr John Camp took up roentgenology of the skull, encephalography, and ventriculography Dr Paul C Hodges gave two lectures on differential diagnosis of skeletal diseases, using mounts of museum specimens from the University of Chicago for demonstration Dr Robert Ball discussed the roentgenology of the stomach, duodenum, and small intestine, and Dr David G Pugh again discussed the diagnosis of diseases of the colon

Dr Laurence L Robbins repeated his course on differential diagnosis of segmental collapse of the lungs Dr John Caffey gave a consideration of the roentgen changes in primary tuberculosis in children Dr Caffey likewise discussed that controversial gland, the thymus, and on the final day lectured on congenital obstructive lesions of the alimentary tract

Dr Wendell G Scott discussed diseases of the gallbladder, cholangiography, and pancreatic disorders Dr Scott, from personal experience, gave a very interesting discussion of the development of present-day gallbladder visualization and showed some of the original films

All of the courses were well attended Most of the forty-eight states were represented, and a few applicants came from Canada, South America, and Poland

All of the speakers were most co-operative and attempted to give basic instructional lectures, covering the subjects as completely as possible in the limited time To them and to the local Refresher Course Committee in Boston, composed of Drs Robert Vance, Phillip Batchelder, Arthur Horrigan, Douglas Roberts, Leslie Sycamore, and Langdon Thaxter, we wish to extend our thanks for a very successful session

The comments which we received on the courses were generally most favorable but again we invite criticisms and suggestions from all members

REFRESHER COURSE COMMITTEE
Paul Swenson, M D
Kenneth Davis, M D
C Edgar Virden, M D , Chairman

The Scientific Exhibits

There were thirty-nine scientific exhibits entered at the Thirty-third Annual Meeting of the Radiological Society of North America, held in Boston, Nov 30–Dec 5, 1947

On the basis of subject matter, there were seven groups skeletal system, eight exhibits, chest, seven exhibits, gastrointestinal system, four exhibits, genitourinary system, three exhibits, therapy, eight exhibits, radioactive isotopes, three exhibits, miscellaneous, six exhibits The space available for the exhibits made it impossible to arrange them in groups according to the above classifications

The following awards were given

First Award Stanley A Wilson, M D , Salem Hospital, Salem, Mass , for his exhibit on "Granulomatosis of Lung, Probably Due to Beryllium "

Second Award John F Holt, M D , and Edwin M Wright, M D , University Hospital, Ann Arbor, Mich , for their exhibit on "Osseous Manifestations of Neurofibromatosis "

Third Award John D Camp, M D , Mayo Clinic, Rochester, Minn , for his exhibit on a "Grid Front Cassette—A Practical Application of the Stationary Grid "

Honorable Mention went to K E Corrigan, Ph D , H S Hayden, Ph D , E F Lang M D , and L Reynolds, M D , Harper Hospital, Detroit, Mich , for their exhibition 'Diagnostic Tracer Studies with Radioactive Iodine "

EXHIBITS PERTAINING TO THE SKELETAL SYSTEM

HAMPAR KELIKIAN, M D, AND E K LEWIS, M D (*Chicago, Ill*) Arthrograms Lipiodol-outlined arthrograms and pneumoarthrograms of the knee, ankle, elbow, and acromioclavicular joints were exhibited The normal anatomy, capacity, contour, content, and communications of these joints as outlined by air injection were shown

ISADORE MESCHAN, M D (*University of Arkansas, Little Rock, Ark*) An Atlas of Pneumoarthrography of the Knee This exhibit utilized diagrams and tracings of radiographs together with tables summarizing statistical data on pneumoarthrography of the knee

E S GURDJIAN, M D, J E WEBSTER, M D, AND H R LISSNER, M S (*Wayne University College of Medicine and Grace Hospital, Detroit, Mich*) Mechanism of Production of Linear Skull Fracture—Studies with the Stresscoat The material presented included experimental work on dogs and monkeys and human studies on cadaver and dry skulls with the stresscoat technic This involves the application of a strain-sensitive lacquer on the external and internal surfaces of the skull Deformation of the skull from blows causes cracks in the lacquer, showing the pattern and direction of the strains

JOHN F HOLT, M D, AND EDWIN M WRIGHT, M D (*University Hospital, Ann Arbor, Mich*) Osseous Manifestations of Neurofibromatosis This exhibit showed many skeletal abnormalities associated with neurofibromatosis (von Recklinghausen), including disorders of bone growth, bowing and pseudoarthrosis of the lower leg, intra- and extra-osseous erosive defects, periosteal thickening and profound congenital anomalies The roentgenograms of two patients showing rib erosion simulating the "pathognomonic" sign of aortic coarctation were shown This exhibit received the Second Award

JACOB H VASTINE, 2ND, M D, AND MARY FRANCES VASTINE, M D (*Woman's Medical College of Pennsylvania, Philadelphia, Penna*) A Roentgen Study of Identical Twins This study of eight sets of twins included photographs, films of the neck, chest, lumbosacral spine and pelvis and hands of each, showing identical patterns of calcification in laryngeal and costal cartilages, identical skeletal structures as seen in the conformation of ribs and transverse processes, and similar degenerative changes as seen in osteoarthritic involvement of the spine

WILLIAM E HOWES, M D, AND B BRUCE ALICANDRI, M D (*Brooklyn, N Y*) The Shoulder Routine and special technics for roentgen examination of the shoulder were illustrated The pathological changes present in a series of interesting cases were demonstrated by these technics

FLEMMING NORGAARD M D (*Dental School of Denmark, Copenhagen, Denmark*) Temporomandibular Arthrography Ordinary x-ray examinations of the temporomandibular joint in most cases of arthros- (arthritis deformans) fail to give any information about the condition of the join and do not allow accurate differentiatio between intra- and extra-articular conditions This exhibit portrayed the use an aqueous iodine-containing contrast medium in the two joint cavities, demonstrating certain pathological conditions, e g obliteration of the joint cavities and degeneration and perforation of the disk

CESARE GIANTURCO, M D (*Carle Hospital Clinic, Urbana, Ill*) Typical Aspect of Bone Tumors This exhibit by means of air-brush drawings made by Dr Gianturco illustrated the artist's impression of the typical radiological appearance of common bone tumors

EXHIBITS PERTAINING TO THE CHEST

HAROLD TEMPLE, M D, I STEINBERG, M D, C T DOTTER, M D (*New York Hospital, New York*) An Improved Method of Angiocardiography Films, slides, and photographs illustrating methods and results of angiocardiography done by means of an automatic rapid change photofluoroscopic unit were displayed

Conventional angiocardiographs were shown in conjunction with the 70 mm films studied

WILLIAM J CORCORAN, M D (*Scranton, Penna*) Anthraco-Silicosis The exhibit demonstrated anthracosilicosis in its different stages, together with cases complicated by tuberculosis and by non-specific infections

STANLEY A WILSON, M D (*Salem Hospital, Salem, Mass*) Granulomatosis of the Lung, Probably Due to Beryllium Characteristic roentgenologic lung changes occurring in persons employed in industries using beryllium compounds were shown Significant features demonstrated were delay in onset (months to years) and the progressive and in many cases irreversible character of the lesions There were several fatalities in the series First Award was given to this exhibit

PEDRO L FARIÑAS, M D (*Habana, Cuba*) Intratracheal Atomization in Bronchography This exhibit illustrated the use of an intratracheal spray of a radiopaque medium for demonstrating abnormalities of the air passages of the lungs

DAVID E EHRLICH, M D, AND HANS ABELES, M D (*Department of Health, New York City*) Isolated Pulmonary Lesions Isolated pulmonary lesions discovered in mass chest x-ray surveys were demonstrated Proved cases of tuberculoma, cancer, and bronchiectatic cyst were included in the series Diagnostic difficulties were demonstrated and the need for careful, conservative differential diagnosis in such surveys was stressed

GEORGE COOPER, JR, M D, AND JOHN R MAPP, M D (*University of Virginia Hospital and Medical School, Charlottesville, Va*) Mesothelial Mediastinal Cysts ("Pericardial Cysts") Differential Diagnosis of Circumscribed Shadows Continuous with the Anterior Inferior Mediastinum This exhibit consisted of chest roentgenograms from five cases of mesothelial mediastinal cysts and six other cases in which a different condition produced a circumscribed shadow continuous with the anterior inferior mediastinum—a large fat pad, a lipoma, a dermoid cyst, a teratoma, a parasternal diaphragmatic hernia, and a metastatic carcinoma The operative and pathological findings for all of the cases were included

IRA LEWIS, M D, T F HILBISH, M D, AND H F A LONG (*U S Public Health Service, Washington, D C*) Pulmonary Lesions Associated with Histoplasmin Sensitivity X-ray reproductions of a series of cases showing pulmonary lesions associated with histoplasmin sensitivity were exhibited

EXHIBITS PERTAINING TO THE GASTRO-INTESTINAL SYSTEM

WILLIAM L PALAZZO, M D, AND MILFORD D SCHULZ, M D (*Massachusetts General Hospital, Boston, Mass*) Spindle-Cell Tumors of the Gastro-Intestinal Tract This exhibit consisted of roentgenograms, photographs, and statistical data for a series of spindle-cell tumors of the gastro-intestinal tract

SAMUEL BROWN, M D, AND ARCHIE FINE, M D (*Jewish Hospital, Cincinnati, Ohio*) The Duodenum—A Roentgen Study in Three Dimensions Roentgenograms showed the duodenum in the anterior and right lateral positions and demonstrated its relationship with the stomach, pancreas, gallbladder, liver, extrahepatic biliary ducts, colon, and right kidney in individuals of different habitus under normal and abnormal conditions

FELIX G FLEISCHNER, M D, AND CHARLES BERNSTEIN, M D (*Beth Israel Hospital, Boston, Mass*) Roentgen Anatomical Studies of the Ileocecal Valve and Observations on Its Pathology Transparencies illustrating and correlating anatomical specimens of the ileocecal valve, microscopic sections, and roentgenograms were shown These showed the normal findings, different types of normal variations, and pathological cases, including pseudolipoma, intussusception, herniation of the mucosa, superficial ileitis and typhlitis, regional ileitis, ulcerative colitis, tuberculosis, carcinoma, malignant lymphoma, and pericecal inflammation

JOHN A CAMPBELL, M D , AND JACK L LOUDERMILK M D (*University Medical Center, Indianapolis, Ind*) Survey Film Diagnosis of Abdominal Conditions The exhibit showed a variety of abdominal conditions detected by plain survey roentgenograms and portrayed the value of such simple studies to the clinician in the analysis of suspected or ambiguous abdominal disease

EXHIBITS PERTAINING TO THE GENITO-URINARY SYSTEM AND OBSTETRICS

EDWIN L PRIEN, M D (*Brookline, Mass*) Analysis of Urinary Calculi by Crystallographic Methods Charts and diagrams set forth in simple language the physical methods used in the analysis of a series of 600 urinary calculi, and photographs showed the structural detail of such calculi A display of typical calculi, indicating their composition, was also included

S A ROBINS, M D , M L BRODNY, M D , AND D ROSEN, M D (*Beth Israel Hospital, Boston, Mass*) Urethrocystography Photographs and roentgenographic reproductions illustrated pertinent examples of lesions which can be demonstrated by urethrocystography in adult males and children

A O HAMPTON, M D , J P MOORE, M D , AND HOWARD R CREWS, M D (*Garfield Hospital, Washington, D C*) Placenta Praevia (Value of Upright Films) The purpose of this exhibit was to show that the fetal head in 96 per cent of all pregnancies normally enters or accurately centers upon the pelvic inlet during the last trimester of pregnancy when the patient is upright Failure of the head to enter or center is pathological

EXHIBITS PERTAINING TO THERAPY

BERNARD E LEVINE, M D , WILLIAM S ALTMAN, M D , AND H F FRIEDMAN, M D (*Beth Israel Hospital, Boston, Mass*) Contact Therapy of Superficial Neoplasms A series of colored slides portrayed the use of contact therapy on superficial neoplasms and showed the end-results of this type of irradiation

WILLIAM H MEYER, M D (*New York Post-Graduate Medical School and Hospital, New York*) The Volume Depth Dose in the 50 Per Cent Absorption Zone in Radiation Therapy This exhibit consisted of charts, drawings, and photographs illustrating a simple method of depth dose designation, the foundation of which is the volume depth dose indicated in the 50 per cent absorption zone

MAURICE A LOEBELL, M D (*Zanesville, Ohio*) Simultaneous Cross-Radiation Simultaneous cross-radiation effects were illustrated by charts, photographs, and roentgenograms

BERNARD ROSWIT, M D AND FRIEDRICH P ELLINGER, M D (*U S Veterans Hospital, Bronx, N Y*) A Clinical Study of Radiation Sickness By means of charts and drawings a method was demonstrated for the clinical study of radiation sickness The effect of the administration of synthetic cortical hormone—desoxycorticosterone acetate (DCA)—on the course of radiation sickness was demonstrated by data obtained in the study of treated cases

JAMES F KELLY, M D , D ARNOLD DOWELL, M D , AND JOHN E DOWNING M D (*Creighton University School of Medicine, Omaha, Nebr*) The X-Rays in Prevention and Treatment of Infections A vivid demonstration was given, by means of charts, of some of the recent work on prevention and treatment of infections by X-rays

NICHOLAS G DEMY, M D (*Bellevue Hospital, New York*) X-Ray Beam Localizer and Tumor Depth Indicator A protractor device was shown for determining the angle the central ray must make with a port and the distance of the lesion from the surface of any port, to assure accurate aiming of the beam through multiple ports and calculation of the depth dose to a tumor A method of localizing the tumor roentgenographically was also shown

ARTHUR W ERSKINE, M D (*Cedar Rapids, Iowa*) Evolution of a Transvaginal Speculum Models of various specula developed since 1937 for treatment of cervical cancer were shown Photo

graphs and descriptions of each model illustrating its advantages and disadvantages were included

EDWIN C ERNST, M D (*Barnard Free Skin and Cancer Hospital, St Louis, Mo*) Improved Expanding Radium Applicator for the Treatment of Cancer of the Cervix The results of further experience with an improved expanding radium applicator for the treatment of cancer of the uterine cervix were demonstrated by means of translucent photographic films and measurement charts of the distribution of radiation through the use of this applicator

EXHIBITS PERTAINING TO RADIOACTIVE ISOTOPES

EDITH H QUIMBY, SC D , AND SIDNEY C WERNER, M D (*Columbia University, New York*) Radioactive Isotopes and Their Use in Problems of the Thyroid Gland By means of a series of charts, the nature, production, and measurement of radioactive isotopes were briefly presented General considerations were given concerning dosage, protection, and safety Tracer and therapeutic uses of isotopes were described, with particular attention to radioactive iodine in conditions of the thyroid gland

KENNETH E CORRIGAN, PH D , HENRIETTA S HAYDEN, PH D , E F LANG, M D , AND LAWRENCE REYNOLDS, M D (*Harper Hospital, Detroit, Mich*) Diagnostic Tracer Studies with Radioactive Iodine The physical factors which must be considered for proper interpretation of a tracer study were demonstrated, and the results which may be expected and some examples of actual cases were shown in transparencies This exhibit received Honorable Mention

HERMAN LISCO, M D , MIRIAM P FINKEL, PH D , AUSTIN M BRUES, M D , JANE GLASER AND GEORGE SVIHLA (*Argonne National Laboratory, Chicago, Ill*) This exhibit consisted of lantern slides, colored photographs, and x-ray demonstration of the delayed, chronic injurious effects of radioactive isotopes when administered in various ways to experimental animals The potential dangers which are inherent in the work with radioactive isotopes were emphasized, particularly the various types of tumors produced in this way

EXHIBITS ON MISCELLANEOUS SUBJECTS

WM H STRAIN, PH D , GLENN E JONES, A L GROHOWSKI, M D , HAROLD D ROBERTSON, GEORGE H RAMSEY, M D , JOHN A SCHILLING, M D (*School of Medicine and Dentistry, The University of Rochester, Rochester, N Y*) Experimental Studies on the Visualization of the Biliary Tract Drawings, prints, and roentgenograms were shown to illustrate comparative rates of biliary tract visualization in dogs after intravenous administration of various cholecystographic agents The exhibit demonstrated that the several media are secreted into the biliary tract at different rates and/or concentrations, that the biliary ducts are visualized prior to the gallbladder, and that the duct system is delineated after cholecystectomy

RAPHAEL POMERANZ, M D , PHILIP J SANTORA, M D , AND A F CAPRIO, M D (*Newark City Hospital, Newark, N J*) Horner's Syndrome, Roentgen Manifestations Various etiological factors which may produce a Horner's syndrome were demonstrated in this exhibit Among the cases presented by means of histories, transparencies, and autopsy findings, were Hodgkin's disease, primary sulcus tumor (Pancoast), metastatic lesions of the neck, neurofibrosarcoma, and lymphosarcoma

GEORGE M WYATT, M D (*Army Institute of Pathology, Washington, D C*) The American Registry of Pathology This exhibit outlined the history of the American Registry of Pathology, its aim, and growth It showed the relationship of the Registry to its component medical societies and demonstrated some of the contributions made for the advancement of knowledge in these societies Part of the exhibit illustrated contributions which have been made to the specialty of radiology

JOHN D CAMP, M D (*Mayo Clinic, Rochester, Minn*) A Grid Front Cassette,

A Practical Application of the Stationary Grid This exhibit consisted of transparencies showing construction of a grid front cassette, one model utilizing the metal Lysholm grid and a second model utilizing the Liebel-Flarsheim grid Data indicating various applications of the grid front cassettes and various original roentgenograms made with them were shown The exhibit was given the Third Award

COL H I AMORY, M C, AND LT-COL R F BUNCH, M C (*Walter Reed General Hospital, Washington, D C*) The Perivascular Injection of Thorotrast and Its Sequelae In arteriographic studies of seven patients, certain sequelae were shown following extravasation of Thorotrast in the paravascular tissues of the neck and the elbow after injection of this material

JAMES J NICKSON, M D, AND MARGARET NICKSON, M D (*Argonne National Laboratory, Chicago, Ill*) A Study of the Hands of Radiologists This exhibit consisted of photographs of the skin ridges and skin capillaries of radiologists and control groups studied during the past year There was also equipment to examine the hands of volunteering radiologists This included a capillary camera and a supply of wax impression compound and various accessories

C E HUFFORD, M D

The Commercial Exhibit

The Commercial Exhibit at the meeting of the Radiological Society of North America held in Boston, Nov 30 to Dec 5, 1947, was a great success, as judged by the interest shown by both visitors and exhibitors Unfortunately, there was not sufficient space to accommodate all would-be exhibitors Despite the rationing of space to the exhibitors who were present, all of them managed to present displays that attracted a great deal of attention Noteworthy trends in the line of x-ray equipment were the substitution of push buttons for toggle switches and increased facility of servicing the control stands

Ansco Corporation (Binghamton, N Y) Ansco had an interesting exhibit of color sense determination test plates By means of colored dots, one was able to determine whether his color sense was normal or abnormal, the normal eye reading certain numbers, while the abnormal eye saw different numbers Some beautiful colored prints made on Printon and effective color transparencies were also shown, and lights, colored clinical photographs, and photomicrographs were displayed A radiograph made on Ansco High-Speed x-ray film was of special interest.

Bracke-Seib X-Ray Co (New York) The Bracke-Seib exhibit featured two therapy machines, one of them having a voltage range from 0 to 50 kv, with a stepless voltage control It is called the Contractron and operates on full-wave rectification and milliamperages ranging from 2 to 50 It has a high output and a short target distance, which can be varied from 2 to 20 or more centimeters

A stepless control also was featured on a mobile unit, which could be used either for radiography or superficial therapy, up to 120 kv This machine is called the Dermatron, and operates on half wave, with 2 valve tubes included

Also shown was the Fluorotron, which consists of a vertical fluoroscope, with a 4 and 1 Scholz spot-filming device An orthodiascope can be attached to this unit.

An interesting item was the new type stereoscope, with which the viewer directs his gaze horizontally at films resting horizontally on a table-top type of illuminator

Buck X-Ograph Co (St Louis, Mo) This exhibit was limited because of the small space available Interesting radiographs made on Bucky Xtra Speed x-ray film were shown on a Buck 8-bank illuminator The illuminator was on a movable base, with a work shelf Literature was available, describing many film processing accessories The Buck Company brought its own settees, whose soft seats were a favorite haven for the weary

Canadian Radium & Uranium Corporation (New York) The Canadian Radium & Uranium Corporation showed a complete line of radium applicators, with special exhibits of the newly developed nylon applicators for treatment of carcinoma of the cervix and body of the uterus There was also an ingenious injector for the intrauterine insertion of multiple radium capsules, for carcinoma of the body of the uterus

A special applicator for the beta ray treatment of ocular lesions was of great interest, as was the announcement of the commercial availability of Radium D, said to be a pure beta ray emitter

Coca Cola Co (Atlanta, Ga) The Coca Cola booth again was a meeting place for the weary and thirsty Although limited in space, it managed to fulfill the needs and quench the thirst of all The Commercial Exhibit would not be quite the same without this very welcome booth

F A Davis Co (Philadelphia, Penna) The F A Davis Company showed a complete line of general books and an extensive line of specialty books Of these, *Clinical Radiology*, by Pillmore, *Roentgen and Radium Therapy* by Delario, *Dermatology in General Practice* by Greenbaum, *Arthritis and Related Conditions* by Bach, attracted the most attention

E I du Pont de Nemours & Co (Wilmington, Del) The spacious du Pont exhibit featured the newly announced Type B-2 fluoroscopic screen This screen is much brighter than previous screens and glows with a green color A chart was shown, depicting the progress of development in screen illumination since 1934 X-ray safety film, x-ray chemicals, and fluoro-film (blue sensitive) were also shown There were some attractive and artistic photographic prints, on Defender paper

Eastman Kodak Co (Rochester, N Y) The new Kodak electric mixer (model 1), for easy, rapid mixing of Kodak processing chemicals was a feature of the Eastman exhibit There were also shown radiographs made on Eastman Blueprint Film, radiographs using the three types of Kodak intensifying screens, the Kodak precision enlarger for copying radiographs, other photographic equipment, including cameras and projectors, and equipment and accessories for radiographic processing

Eldorado Mining & Refining Co (Ottawa, Ontario) This year marked the first appearance of this company with our Society The exhibit was relatively small, because of space limitations and also because the company was endeavoring to ascertain the type of exhibit in which the visitors were interested The Campbell applicator for carcinoma of the cervix and the Campbell inserter for treatment of fundus carcinoma were shown Various radium needles were exhibited, some of them being unusually long An interesting feature was the intranasal applicator, notched for determination of distance There was also a dummy applicator, designed to allow the operator to familiarize himself with the technic of application, and useful for familiarizing the patient with the procedure

Eureka X-Ray Tube Co (Chicago, Ill) The Eureka Company showed an exhibit of ray-proof and shock-proof tubes The newest item was their newly developed anode tube This was shown in a stainless steel casing, which is very attractive The tube is said to have a high heat capacity and an oil expansion chamber, with a heat regulator pin This pin enables a determination of high heat content without restriction of the individual exposure The rest of the exhibit consisted of the standard models of over- and under-the-table diagnostic tubes and dental x-ray tubes

General Electric X-Ray Corporation (Chicago, Ill) The General Electric Corporation included, as part of their exhibit, the Pako Filmachine, consisting of a complete automatic unit for the processing of radiographs It has a capacity of one film per minute

A new 200-milliampere vertical automatic control panel was also demonstrated, with push button stations for the various levels of milliamperage and an automatic change of kilovolt indicator The indicator made ingenious use of lucite A

newly developed combination milliampere and milliampere second meter (not a ballistic type) was shown A swinging panel on the front side of the control exposed most of the interior for servicing A timer for both treatment and fluoroscopy is standard equipment There were also photographs of model 30 General Electric processing chemicals and cassettes Shown by photograph also was the 100-million-volt Betatron Another item was the newly designed 100-kv Maximar 100 therapy unit, featuring the beryllium window tube The useful range of this equipment is from 25 to 100 kv Its kilovoltage control is stepless

George W Borg Corp (Delavan, Wis) The George W Borg Corporation showed a new therapy unit, which attracted considerable interest It consists of a 200-kilovolt, self-contained x-ray generator It was said that a full rectification of high frequency makes possible the small size of the therapy head for the voltage obtained Its output was given as 15 milliamperes at 250 kv The tube head is supported by a Gantry type tube stand, and has remarkable flexibility The vertical travel is motor driven, with a positive no-coasting stop The other motions are either manual or vernier controlled All of the wiring and hose connections are concealed, as is the oil cooler The filters are contained in a motor-driven turret type of housing, controlled from the control panel

High Voltage Engineering Corporation (Cambridge, Mass) This company, a newcomer to our meeting, displayed photographs of the newly developed 2-million-volt Van de Graaff generator therapy machine The machine combines extreme compactness and small size, for the available voltage, with flexibility and ease of control The control panel was displayed It also is extremely small in relation to the high voltage attained It is, in fact, a desk model and smaller than the usual 200-kv therapy control Photographs were shown of output intensities, expressed in roentgens, and of depth dose curves, illustrating the high output and large percentage depth dose available

Kelley-Koett Manufacturing Co (Covington, Ky) The Kelley-Koett display occupied the entire stage in the exhibition room, and was quite extensive A featured item was the new Type B table for radiography and fluoroscopy The table incorporated the newly designed Scholz 4 and 1 spot-film device and a shock-proof tube under the table The tube stand is of new design, being much larger than the usual and of extremely rigid construction The horizontal tube travel features a motor-operated lock All locks are operable from the operator's side of the table The high tension cables are geared over wheels attached to the tube column, which are geared to the cable running in the upright tube support The radiographic generator is newly designed for the inclusion of two high-tension oil-immersed switches, thus allowing the use of three x-ray tubes The generator is rated at 140 kv at 10 ma and 300 ma at 120 kv A new vertical control for the generator features the new off-white smooth baked enamel finish (kellekote) The front of the control panel is hinged, to allow for ease of service The timer is a combination electronic and mechanical device The fluoroscope model control for the same generator has its top hinged for service Both control units have independent fluoroscopic kilovoltage control A 250-kv therapy unit, entirely self-contained, was also shown All of the operations were manually controlled

Lea & Febiger (Philadelphia, Penna) Lea & Febiger displayed a rather general line of medical books Those of particular interest to the radiologists were *X-ray and Radium in the Treatment of Diseases of the Skin* (revised) by MacKee and Cipollaro, *Roentgen Interpretation* (revised) by Holmes and Robbins, *Urologic Roentgenology* (revised) by Wesson, *Normal Encephalogram* by Davidoff and Dyke, *Roentgen Treatment of Diseases of the Nervous System* by Dyke and Davidoff, *Roentgenographic Technique* by Rhinehart Also announced was a revised combined edition of Pohle's work, which will be called *Clinical Roentgen Therapy*

Liebel-Flarsheim Co (Cincinnati, Ohio) The Liebel-Flarsheim display featured their new bantam Bucky, consisting of a portable Bucky, containing either a standard or high-speed 50-line grid, with a 6 5 to 1 ratio It weighs 17 lb and accepts a 10 × 12 cassette A subject of considerable interest was the automatic reciprocating Bucky (Morgan-Hodges principle) This is used with a special control, incorporating a 1/20 of a second timer

A serialographic tunnel was also displayed It can be used in place of the Bucky tray The well known Liebel-Flarsheim precision therapy timer was shown, as was a stationary filter grid There was literature describing the roentgen kymograph and the Hugh H Young urological x-ray table

Machlett Laboratories, Inc (Springdale, Conn) The center of the Machlett display was the 2-million-volt x-ray tube, used in the Van de Graaff generator Also shown were varieties of x-ray tubes used for dental, mobile, radiographic, deep therapy, and industrial x-ray procedures A feature of the display was the new under-the-table model of the Dynamax 26, designed for fluoroscopic and spot-film work It contained two 1 5-mm focal spots Only one is connected at any one time The tube does not rotate during fluoroscopy, but is automatically brought to almost full speed for filming Filming is possible at up to 200 ma at 80 kv , the permissible time is two seconds The heat rating is the same as the Dynamax 25 AA

F Mattern Manufacturing Co (Chicago, Ill) The Mattern display included a tilting fluoroscopic radiographic table, with bilateral driving gears, giving an unusually smooth, silent action There was a new Dynamax 26 rotating anode tube, under-the-table A spot-film device of the 4 and 1 Scholz type featured a photo timer, using the Morgan-Hodges principle The control panel was of the upright type and fully automatic Also shown were a fully automatic deluxe control panel for a 100-ma generator and a mobile unit with a top rating of 90 kv p at 4 5 ma for therapy, and 60 ma for radiography A stereoscopic cassette for chest work was well prepared for the use of a photo timer

Wm Meyer Co (Chicago, Ill) The Wm Meyer Company exhibit featured a head and specialty unit, consisting of a support structure and control stand, with a tube head mounted at one end and a 10 × 12 Bucky mounted at the other end of an arched support The unit was very compact and extremely flexible It was rated at 90 kv p and 30 ma Also shown was a portable type Bucky, which could be used either vertically or horizontally It accommodated a 14 × 17 cassette A rather ingenious mobile unit, of the knockdown type, was demonstrated It actually could be used as a portable unit

Thomas Nelson & Sons (New York) Thomas Nelson & Sons showed a complete line of medical textbooks Those which attracted the radiologists were *Diagnostic Roentgenology* by Ross Golden and the Nelson series on surgery and medicine

North American Philips Co (New York) The Philips Company showed many interesting items, including the familiar contact therapy unit, which operates at a fixed 50 kv , at 2 ma The focal skin distance can be varied from 1 8 to 25 cm A very well designed, practical, pedestal type Bucky was shown It can be used both vertically and horizontally, and can be elevated by use of a hydraulic lift, operated by a foot pedal A bakelite topped cart, to be used in connection with the pedestal Bucky, was on display There was also an ingenious utility seat, which may be used separately, for dental films, or in connection with the pedestal Bucky, for encephalography, pelvimetry, and routine spine work A newly designed pelvic plain film distance marker was demonstrated The M C S unit consists of an integrated tube and filming device, for the photo roentgen filming of chests Included in the exhibit was a tilting fluoroscopic, radiographic table, containing an Aeromax 26 tube beneath the table A Scholz 4 and 1 spot-film device was used above the table There was also an adjustable stop, limiting the screen motion

during myelography The automatic 300 ma control panel featured separate radiologic and fluoroscopic voltage settings and stepless voltage control

There was also shown an automatic tube overload control The last item in the exhibit was a cassette changer for chest filming, featuring a pendulum drive It also was prepared for the use of a photo timer

H B Odmann (Leonia, N J) Mr Odmann was making his first appearance in six years, during which time he was undergoing surgery for the replacement of radiation-damaged skin on his hands He showed both the old standard line of intracavitary cones and a new mount for these cones, featuring a new reflecting device He also displayed his model of a visual localizer for therapy Of considerable interest were his plastic compression cones, designed to be used with visual localizers A pointer of the same material also was designed for use with the visual localizer

Picker X-Ray Corporation (New York) The large Picker exhibit attracted much attention One of the most interesting items shown was the 250-kv , 15 ma self-contained therapy unit All of the motions are motor driven A vertical control panel is used with this unit The new Gianturco sinus-filming device permits the use of 5 × 7 films in a curved arm, attached to a piece which fits into the usual cone slot A transparent front allows for accurate positioning of the patient prior to inserting the film Also of great interest was an x-ray beam localizer and x-ray depth indicator for deep therapy

A late-comer, but of great interest, was the Anhydrator This self-contained unit dries x-ray film without the use of heat It is rapid in action, drying 24 films in ten minutes A chemical process is used The chemical is rejuvenated during the night and is ready for a full day's work the next morning

Picker's new, all-electronic control, the Pictronic 200, also was shown It features a new type of milliampere stabilizer and a delay switch on the 200-ma setting, to allow for the rotor of the tube to be energized The exposure is made with the delay switch, when it is released against a spring tension The accompanying table featured a serialographic spot-filming device, allowing for 1, 2, or 4 films to be made on an 8 × 10 cassette The film rotates during the exposures There is a myelographic stop device on the screen support An interesting feature was the 18-in focal skin distance, allowing for the use of a rotating anode tube under the table

Professional Equipment Co (Chicago, Ill) The Professional Equipment Company display featured an 80-kv , 20 ma. self-rectifying x-ray tube head, available as a portable mobile, horizontal, and upright table combination An upright fluoroscope with the same head also was shown. The control panel gives a variation from 50 to 80 kv in steps of 10

Radiology (Detroit, Mich) Radiology occupied a prominent booth near the entrance Since its product is universally accepted, no large display was considered necessary Two large panels showed the scope of the Abstract Service and outstanding features of the journal An announcement was made of the forthcoming supplement to the Cumulative Index

Radium Chemical Co (New York) The Radium Chemical Company exhibit featured Dr Ernst's latest design of radium applicator, for the treatment of carcinoma of the cervix The unit appeared to be extremely well machined and created much interest Also shown was a very complete line of radium applicators

Standard X-Ray Co (Chicago, Ill) The Standard X-ray Company displayed their newly developed Imagraph This is a photo roentgen unit utilizing a 70-mm film The display also included photographs of a double-column therapy unit and of a therapy control stand

Victoreen Instrument Co (Cleveland, Ohio) Mr Victoreen's small booth was extremely popular with those who are desirous of maintaining the best possible relationship between their occupation and their health The old reliable Iometer and Integron were displayed The Protexi-

meter allows for a total dose calibration for protection purposes The familiar Mini-meter showed signs of considerable development and appeared to be much better machined than in previous years A radiation survey meter was shown This meter reads in milliroentgens per minute and allows determination of the rate of exposure at any particular time, in any particular place The Victoreen R-meter appeared to be the same as always A new item was the Geiger counter

Westinghouse Electric Corporation (Pittsburgh, Penna) Westinghouse occupied a prominent place, opposite the entrance to the exhibit hall Many items were shown, but the one that attracted most attention was the new Duoflex table, with cable drive, which allows for an unusually high position of the fluoroscopic screen, in relation to the head of the table A new 4 on 1 spot-film device was shown It was an improvement over the original model, shown one year ago All four films are made in the same position A Morgan Hodges photo timer was included on this screen A 12 × 16-in stationary grid was available, just in front of the lead glass An extra grid is available in front of the x-ray film, if desired The control stand is entirely automatic and wall mounted It is of smaller size than the usual vertical control A new radiographic tube, designed for operation at 125 kv was demonstrated It is rated at 3 5 ma constancy at the peak kv p voltage The old familiar single-column therapy tube stand, accommodating a 250-kv p head, reappeared this year The double column tube stand also was shown Both of these accommodate the del Regato or Odmann visual localizers A feature of the double column tube stand is an electric lock on the in and out and crosswise motions A vernier control wheel is utilized for the up and down motions of the tube

Winthrop Chemical Co (New York) The Winthrop-Stearns display received a heavy play from the visitors The items included Diodrast, both 35 and 70 per cent, Skiodan, p Hisoderm (a lathering detergent cream), Zephiran, Demerol, and Cream-alin A large print, illustrated the use of Diodrast in cholangiography

Wolf X-Ray Products (New York) This exhibit consisted entirely of a large number of x-ray accessories Bank illuminators were shown in various sizes and shapes, for medical and dental use There were gloves, aprons, and chairs, designed for protection from x-ray, processing room lights, film hangers, and racks for supporting the hangers, a serialographic tunnel, a Wolf cassette and adjustable height single cassette holder

Wright Engineering Co (Mountain Lakes, N J) A last-minute booth was created for this display, and very fortunately so It featured the newly developed Iris type of radiographic cone The opening in the Iris diaphragm is controlled by a knurled knob Apertures covering various sizes of films can be obtained at almost any focal skin distance, by use of this device An indicator designates the film coverage, at any distance, at any setting A central, removable light directs the path of the primary beam

X-Ray Equipment & Research (Washington, D C) This exhibit featured units developed in cooperation between the United States Army and the Bureau of Standards The purpose of the exhibit was to obtain the reaction of radiologists to the units that were shown An attempt was made to develop units that could be assembled and knocked down rapidly, would fit into standard-sized packages, and would withstand abuse in handling On display were a light-weight, transportable, horizontal radiographic and fluoroscopic table, a single tube, motor-driven tilting radiographic and fluoroscopic table, and a dental unit

Year Book Publishing Co (Chicago, Ill) The Year Book Company featured its *Year Books*, covering various phases of medicine The popular *Year Book of Radiology* needs no introduction to radiologists Other specialty books included *Medical Physics*, edited by Otto Glasser

T J WACHOWSKI, M D

THIRD INTER-AMERICAN CONGRESS OF RADIOLOGY

Under the direction of the Chilean Radiological Society, work has already been begun on the organization of the Third Inter-American Congress of Radiology to be held in Santiago, Chile, in 1949 In accordance with Articles V and VII of the statutes governing the Inter-American Congresses, the following Executive Committee has been appointed Dr Felix J Daza, President, Dr César A Velasco, Secretary, Dr Alberto F Ricci, Treasurer

The official subjects to be covered at the Congress are as follows "Radiological Exploration of the Cardiovascular System" and "Cranial Radiology (Simple)" in the field of diagnosis, and "Cancer of the Mouth" and "Female Genital Tumors" in the therapeutic field The Executive Committee will choose four other subjects which will be added to these four as main topics of discussion Papers may be offered, however, on any subject relating to radiology

Further communications will be made from time to time in these pages as information is available

SOCIADADE BRASILEIRA DE RADIOTERAPIA

The officers of the Brazilian Society of Radiotherapy for 1947–48 are President, Oscar Rocha von Pfuhl, M D , Secretary, Andrelino Amaral, M D , Treasurer, Z Themudo Lessa, M D The society meets on the second Tuesday of each month at 9 P M , in São Paulo (Avenida Brigadeiro Luiz Antonio, 644)

In Memoriam

JAMES MADISON MARTIN, M D

1867–1947

Dr James Madison Martin, for many years a member of the Radiological Society of North America, died on Sept 26, 1947, at the age of 80 in Dallas, Texas, after a long illness

Dr Martin was born on a farm in Phelps County, Missouri, on Dec 11, 1867, and as a young man associated himself with a master mechanic, who taught him shop work and cabinet making He maintained an interest in mechanics during his entire life and even in his later years spent much of his spare time in making beautiful pieces of furniture His early education was obtained at the Valparaiso Normal and Business Institute in Indiana and the Vichy Normal and Business Institute in Vichy Springs, Missouri

He received his medical degree from the St Louis

James M Martin M D

College of Physicians and Surgeons in 1890, and in 1892 settled in the small village of Massey, located in the blackland belt of Texas, as a general practitioner Here he built a rather elaborate drugstore equipped with a laboratory for bacteriological and blood studies, an ambitious undertaking for a young physician located in the ranch country 12 miles from a railroad

In 1901, Dr Martin moved to Hillsboro, Texas. At that time his interest in mechanics induced him to obtain a wall plate and a static machine, about which he knew so little that he took an extensive correspondence course in electrophysics In 1903 one of Pusey's first articles on the treatment of skin cancer with x-rays fell into his hands and he elaborated a similar technic, which is still considered a useful procedure

In 1904 he accepted the professorship in Electro-Therapeutics and X-ray Methods in the Dallas Medical College, and in 1906 he moved to Dallas, where he set up one of the first laboratories in the southwest devoted exclusively to the use of electrical methods and x-rays in medicine As no suitable textbooks were then available, Dr Martin prepared a mimeographed syllabus for his lecture course, which was subsequently published in book form, under the title *Practical Electrotherapeutics and X ray Therapy*

The section on skin cancer illustrates results which cannot be excelled today

Dr Martin served as Professor of Radiology in the Baylor Medical School for many years and was Professor Emeritus of Radiology in the new Southwestern Medical College at the time of his death He was a past president of the Texas Radiological Society, the Dallas County Medical Society, the Dallas Southern Clinical Society, the Dallas Doctors' Luncheon Club, the Texas Geographic Society, and the American College of Radiology

Dr Martin was a true pioneer in the practice of radiology, to which he gave a constant enthusiasm and a degree of energetic support which will not soon be forgotten in the southwest He was deeply interested in photography and made a large number of excellent motion pictures many of which were in color

In 1893 Dr Martin was married to Emma Auerbach, of Edgar Springs, Missouri He is survived by one son, Dr Charles L Martin, with whom he organized the Martin X-ray and Radium Clinic in Dallas in 1940, and a grandson, Dr James A Martin, now a Lieutenant (JG) in the Navy

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender Reviews will be published in the interest of our readers and as space permits

SÔBRE A CISTICERCOSE ENCEFÁLICA ESTUDO CLINICO, ANÁTOMO-PATOLÓGICO, RADIOLÓGICO E DO LÍQUIDO CÉFALO-RAQUEANO By DRS PAULO PINTO PUPO, WALDEMAR CARDOSO, JOÃO BATISTA DOS REIS, and CELSO PEREIRA DA SILVA From the Hospital de Juqueri and the Neurological Service of the Escola Paulista de Medicina Separata dos "Arquivos da Assistencia a Psicopatas do Estado de S Paulo," Vol X-XI, Janeiro Dezembro 1945–46 N° unico D Juquerí, São Paulo, Brasil, 1947

HANDBOOK ON FRACTURES By DUNCAN EVE, JR, M D, F A C S, Surgeon-in-Chief, Nashville, Chattanooga and St Louis Railroad, District Surgeon, Louisville and Nashville Railroad, Associate Professor of Surgery, Vanderbilt University School of Medicine, Member of the Southern Surgical Society, Member of the American Association for the Surgery of Trauma, Chairman of the Committee on Fractures of the Medical and Surgical Section of the American Railroad Association, Member of the Committee on Fractures of the American College of Surgeons, Attending Surgeon, St Thomas Hospital, Nashville, Tennessee In collaboration with TRIMBLE SHARBER, M D, Attending Surgeon, St. Thomas Hospital, Nashville Tennessee A volume of 263 pages, with 129 illustrations Published by The C V Mosby Company, St Louis, Mo Price $5 00

Book Reviews

HODGKIN'S DISEASE AND ALLIED DISORDERS By HENRY JACKSON, JR., A B, M D, Assistant Professor of Medicine, Harvard Medical School, Associate Physician, Thorndike Memorial Laboratory, Boston City Hospital, and FREDERIC PARKER, JR, A B, M D, Associate Professor of Pathology, Harvard Medical School, Pathologist-in-Chief, Boston City Hospital A volume of 177 pages, with 15 plates Published by the Oxford University Press, New York, 1947 Price $6 50

For this work on a group of diseases frequently designated rather uncritically as the "lymphomas," the authors have chosen the title "Hodgkin's Disease and Allied Disorders" They decry the use of the former term as confusing and, indeed, actually incorrect

The Section on Hodgkin's disease occupies by far the greater part of the text—106 pages, to which are appended seven full-page plates Under seven headings, all phases of the diagnosis and clinical course of the disease are discussed, and adequate lists of references covering each are supplied The "allied disorders" include reticulum-cell sarcoma, lymphocytoma and lymphoblastoma, lymphosarcoma, giant-cell lymphoma, plasmocytoma, and endothelioma The chapters devoted to these diseases are relatively brief but present the main clinical features Each has its own list of references and illustrations

The authors introduce a new term, "Hodgkin's paragranuloma," employing the prefix *para* in the sense of "in close relation to" This designation they apply to certain cases which, rather unfortunately, have previously been referred to as "early Hodgkin's" This paragangliomatous form, they believe, may bear the same relationship to true Hodgkin's granuloma that a primary tubercle does to fibrocaseous tuberculosis It may, it is true, prove to be a precursor of the granulomatous type of disease but, on the other hand, the patient may live for years unembarrassed by the condition Of 28 patients followed by the authors, 15 were alive and symptomless for five years or longer, 5 had survived for fifteen years

The description of radiotherapy is brief and lacking in technical details, which the authors believe should be left to the radiologist in charge of the actual therapy In spite of this, the radiotherapist as well as the diagnostician will find much of value in the monograph.

THE 1947 YEAR BOOK OF RADIOLOGY Diagnosis, edited by CHARLES A WATERS, M D, Assistant Professor of Roentgenology, Johns Hopkins University School of Medicine, Associate Editor,

WHITMER B FIROR, M D , Instructor in Roentgenology, Johns Hopkins University School of Medicine Therapeutics, edited by IRA I KAPLAN, M D F A C R , Director, Radiation Therapy Department, Bellevue Hospital, New York City, Clinical Professor of Surgery, New York University Medical College, Associate Editor, SIDNEY RUBENFELD, M D , Visiting Radiation Therapist, Bellevue Hospital, Clinical Instructor in Surgery, New York University Medical College A volume of 416 pages, with 287 illustrations Published by the Year Book Publishers, Inc , Chicago, Ill Price $5 50

The 1947 Year Book of Radiology is the sixteenth in this well known series There is little to say of it that has not been said of its predecessors It continues to constitute an excellent review of the radiological literature, concise but detailed enough to be of value to those who have not available the original papers which are abstracted Numerous illustrations add greatly to its usefulness

Dr Waters and Dr Firor have edited the section on Diagnosis with their accustomed care With this number they relinquish a task to which they have given their best since they assumed it with the first issue of the Year Book The choice of their successors—Dr Fred Jenner Hodges and Dr John F Holt of the University of Michigan—is an especially fortunate one and ensures a continuance of the high standards previously set

Dr Ira Kaplan and his associate, Dr Sidney Rubenfeld, continue to be responsible for the section on Radiotherapeutics The Introduction to this section, as always, is of special interest in calling attention to the highlights of the year in this field

STEREOSCOPIC ATLAS OF NEUROANATOMY By H S RUBINSTEIN, M D , PH D , Director of the Alfred Ullman Laboratory for Neuro psychiatric Research, Sinai Hospital, Baltimore, Md , and C L DAVIS M D , Professor of Anatomy, School of Medicine, University of Maryland. An atlas consisting of 43 separate plates Published by Grune & Stratton, New York, 1947

Drs Rubinstein and Davis in co operation with their publishers have prepared a rather unique atlas of neuroanatomy It consists of 43 separate plates printed on heavy cardboard and an accompanying descriptive manual of twenty pages, attractively boxed The plates illustrate in stereoscopic photographs and accompanying pen and ink sketches the various steps in dissection of the brain and the structures thus revealed, while the manual outlines the method of dissection The first five plates demonstrate the gross embryological development, while the succeeding ones take up the various steps in the dissection The directions in the manual are concise and to the point, wasting no words An adequate anatomical index is included

This atlas will be of special interest to the neurologist and neurosurgeon but the roentgenologist will also find it an excellent reference work for reviewing the anatomy of the brain

RADIOLOGICAL SOCIETIES SECRETARIES AND MEETING DATES

Editor's Note Secretaries of state and local radiological societies are requested to co-operate in keeping this section up to-date by notifying the editor promptly of changes in officers and meeting dates Address Howard P Doub, M D , The Henry Ford Hospital, Detroit 2, Mich

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA *Secretary Treasurer*, Donald S Childs, M D , 607 Medical Arts Bldg , Syracuse 2, N Y

AMERICAN RADIUM SOCIETY *Secretary*, Hugh F Hare, M D , 605 Commonwealth Ave., Boston 15, Mass

AMERICAN ROENTGEN RAY SOCIETY *Secretary*, Harold Dabney Kerr, M D , Iowa City, Iowa

AMERICAN COLLEGE OF RADIOLOGY *Secretary*, Mac F Cahal 20 N Wacker Dr , Chicago 6 Ill

SECTION ON RADIOLOGY, A M A *Secretary*, U V Portmann, M D , Cleveland Clinic, Cleveland 6, Ohio

Alabama

ALABAMA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Courtney S Stickley, M D , Bell Bldg Montgomery Next meeting at the time and place of the Alabama State Medical Association meeting

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY *Secretary*, Fred Hames, M D , Pine Bluff Meets every three months and annually at meeting of State Medical Society

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY *Secretary*, Sydney F Thomas, M D , Palo Alto Clinic, Palo Alto

LOS ANGELES COUNTY MEDICAL ASSOCIATION, RADIOLOGICAL SECTION *Secretary*, Moris Horwitz, M D , 2009 Wilshire Blvd , Los Angeles 5 Meets second Wednesday of each month at County Society Bldg

PACIFIC ROENTGEN SOCIETY *Secretary*, L Henry Garland, M D , 450 Sutter St , San Francisco 8 Meets annually with State Medical Association

SAN DIEGO ROENTGEN SOCIETY *Secretary*, R F Niehaus M D 1831 Fourth Ave San Diego Meets first Wednesday of each month

X RAY STUDY CLUB OF SAN FRANCISCO *Secretary*, Ivan J Miller, M D , 2000 Van Ness Ave Meets monthly on the third Thursday at 7 45 P M January to June at Lane Hall Stanford University Hospital, and July to December at Toland Hall University of California Hospital

Colorado

DENVER RADIOLOGICAL CLUB *Secretary*, Mark S Donovan, M D , 306 Majestic Bldg , Denver 2 Meets third Friday of each month at the Colorado School of Medicine and Hospitals

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY *Secretary*, Robert M Lowman, M D , Grace-New Haven Hospital, Grace Unit, New Haven Meetings bimonthly, second Thursday

Florida

FLORIDA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, J A Beals, M D , St Luke's Hospital, Jacksonville Meets semiannually, in April, preceding the annual meeting of the Florida Medical Society, and in November

Georgia

GEORGIA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Robert Drane, M D , De Renne Apartments, Savannah Meets in November and at the annual meeting of State Medical Association

Illinois

CHICAGO ROENTGEN SOCIETY *Secretary*, T J Wachowski, M D , 310 Ellis Ave , Wheaton Meets at the Palmer House, second Thursday of October, November, January February, March, and April, at 8 00 P M

ILLINOIS RADIOLOGICAL SOCIETY *Secretary-Treasurer*, William DeHollander, M D , St Johns' Hospital, Springfield Meetings quarterly as announced

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY *Secretary*, John H Gilmore, M D , 720 N Michigan Ave , Chicago 11

Indiana

INDIANA ROENTGEN SOCIETY *Secretary-Treasurer*, J A Campbell, M D , Indiana University Hospitals, Indianapolis 7 Annual meeting in May

Iowa

IOWA X-RAY CLUB *Secretary*, Arthur W Erskine, M D , 326 Higley Building, Cedar Rapids Meets during annual session of State Medical Society

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Sydney E Johnson, M D 101 W Chestnut St., Louisville.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L Pirkey, Louisville General Hospital Louisville 2 Meets second Friday of each month at Louisville General Hospital

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Johnson R Anderson, M D , No Louisiana Sanitarium, Shreveport Meets with State Medical Society

ORLEANS PARISH RADIOLOGICAL SOCIETY *Secretary*, Joseph V Schlosser, M D, Charity Hospital of Louisiana, New Orleans 13 Meets first Tuesday of each month

SHREVEPORT RADIOLOGICAL CLUB *Secretary*, Oscar O Jones, M D, 2622 Greenwood Road Meets monthly September to May, third Wednesday, 7 30 P M

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION *Secretary*, Harry A Miller, 2452 Eutaw Place, Baltimore

Michigan

DETROIT X-RAY AND RADIUM SOCIETY *Secretary-Treasurer*, E R Witwer, M D, Harper Hospital, Detroit 1 Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS *Secretary-Treasurer*, R B MacDuff, M D, 220 Genesee Bank Building, Flint 3

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY *Secretary*, C N Borman, M D, 802 Medical Arts Bldg, Minneapolis 2 Regular meetings in the Spring and Fall

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY *Secretary*, John W Walker, M D, 306 E 12th St, Kansas City, Mo Meetings last Friday of each month

ST LOUIS SOCIETY OF RADIOLOGISTS *Secretary*, Edwin C Ernst, M D, 100 Beaumont Medical Bldg Meets on fourth Wednesday of each month, October to May

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Ralph C Moore, M D, Nebraska Methodist Hospital, Omaha 3 Meetings third Wednesday of each month at 6 P M in either Omaha or Lincoln

New England

NEW ENGLAND ROENTGEN RAY SOCIETY *Secretary-Treasurer*, George Levene, M D, Massachusetts Memorial Hospitals, Boston, Mass Meets monthly on third Friday at Boston Medical Library

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY *Secretary-Treasurer*, Albert C Johnston, M D, Elliot Community Hospital, Keene Meetings quarterly in Concord

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY *Secretary*, Raphael Pomeranz, M D, 31 Lincoln Park, Newark 2 Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC *Secretary*, William J Francis, M D, East Rockaway L I

BROOKLYN ROENTGEN RAY SOCIETY *Secretary-Treasurer*, Abraham H Levy, M D, 1354 Carroll St, Bklyn 13 Meets fourth Tuesday of every month October to April

BUFFALO RADIOLOGICAL SOCIETY *Secretary Treasurer* Mario C Gian, M D, 610 Niagara St, Buffalo 1 Meetings second Monday evening each month October to May, inclusive

CENTRAL NEW YORK ROENTGEN SOCIETY *Secretary-Treasurer*, Dwight V Needham, M D, 608 E Genesee St, Syracuse 10 Meetings in January, May, and October

LONG ISLAND RADIOLOGICAL SOCIETY *Secretary*, Marcus Wiener, M D, 1430 48th St, Brooklyn 19 Meetings fourth Thursday evening each month at Kings County Medical Bldg

NEW YORK ROENTGEN SOCIETY *Secretary*, Wm Snow, M D, 941 Park Ave, New York 28

ROCHESTER ROENTGEN-RAY SOCIETY *Secretary*, Murray P George, M D, 260 Crittenden Blvd, Rochester 7 Meets at Strong Memorial Hospital, third Monday, September through May

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA *Secretary-Treasurer*, James E Hemphill, M D, Professional Bldg, Charlotte 2 Meets in May and October

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY *Secretary*, Charles Heilman, M D, 1338 Second St N, Fargo

Ohio

OHIO RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Carroll Dundon, M D, 2065 Adelbert Road, Cleveland 6 Next meeting at annual meeting of the State Medical Association, Cincinnati, March 31, 1948

CENTRAL OHIO RADIOLOGICAL SOCIETY *Secretary*, Edward T Kirkendall, M D, 700 North Park St, Columbus 8

CINCINNATI RADIOLOGICAL SOCIETY *Secretary*, Eugene L Saenger, M D, 735 Doctors Bldg Cincinnati 2. Meets last Monday, September toMay

CLEVELAND RADIOLOGICAL SOCIETY *Secretary-Treasurer*, George L Sackett, M D, 10515 Carnegie Ave, Cleveland 6 Meetings at 6 30 P M. on fourth Monday, October to April, inclusive.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Peter M Russo, M D, 230 Osler Building, Oklahoma City Meetings three times a year

Oregon

OREGON RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Wm Y Burton, M D , 242 Medical Arts Bldg , Portland 5 Meets monthly, on the second Wednesday, at 8 00 P M , in the library of the University of Oregon Medical School

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY *Secretary Treasurer*, Sydney J Hawley, M D , 1320 Madison St , Seattle 4, Wash Meets annually in May

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, James M Converse M D , 416 Pine St , Williamsport 8 Meets annually

PHILADELPHIA ROENTGEN RAY SOCIETY *Secretary*, Calvin L Stewart, M D , Jefferson Hospital, Philadelphia 7 Meets first Thursday of each month at 8 00 P M , from October to May in Thomson Hall, College of Physicians, 21 S 22d St

PITTSBURGH ROENTGEN SOCIETY *Secretary-Treasurer*, R P Meader, M D , 4002 Jenkins Arcade, Pitts burgh 22 Meets second Wednesday of each month at 6 30 P M , October to June

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Maurice D Frazer, M D , Lincoln Clinic, Lincoln, Nebr

South Carolina

SOUTH CAROLINA X-RAY SOCIETY *Secretary-Treasurer*, Robert B Taft, M D , 103 Rutledge Ave , Charleston 16

Tennessee

MEMPHIS ROENTGEN CLUB Meetings second Tuesday of each month at University Center

TENNESSEE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, J Marsh Frére, M D , 707 Walnut St , Chattanooga Meets annually with State Medical Society in April

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB *Secretary*, X R Hyde, M D , Medical Arts Bldg , Fort Worth 2 Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months

TEXAS RADIOLOGICAL SOCIETY *Secretary-Treasurer*, R P O'Bannon, M D 650 Fifth Ave Fort Worth 4 Next meeting Jan 17 1948

Utah

UTAH STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer* M Lowry Allen, M D , Judge Bldg , Salt Lake City 1 Meets third Wednesday, January, March, May, September, November

UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE *Secretary*, Henry H Lerner, M D Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital

Virginia

VIRGINIA RADIOLOGICAL SOCIETY *Secretary*, E Latan Flanagan, M D , 215 Medical Arts Bldg , Richmond 19

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Homer V Hartzell, M D , 310 Stimson Bldg , Seattle 1 Meetings fourth Monday October through May, at College Club, Seattle

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY *Secretary-Treasurer*, A Melamed, M D , 425 E Wisconsin Ave , Milwaukee 2 Meets monthly on second Monday at the University Club

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY *Secretary*, S R Beatty, M D , 185 Hazel St , Oshkosh Two-day meeting in May and one day at annual meeting of State Medical Society in September

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE Meets first and third Thursdays 4 to 5 P M , September to May, inclusive, Room 301, Service Memorial Institute 426 N Charter St , Madison 6

Puerto Rico

ASOCIACION PUERTORRIQUEÑA DE RADIOLOGIA —*Secretary*, Jesus Rivera Otero, M D , Box 3524, Santurce, Puerto Rico

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CANADIAN ASSOCIATION OF RADIOLOGISTS *Honorary Secretary-Treasurer*, E M Crawford, M D , 2100 Marlowe Ave , Montreal 28, Quebec Meetings in January and June

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES *General Secretary*, Origéne Dufresne, M D , Institut du Radium, Montreal Meets on third Saturday of each month

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA Offices in Hospital Mercedes Havana Meets monthly

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA. *General Secretary*, Dr Dionisio Pérez Cosío, Marsella 11, México, D F Meetings first Monday of each month

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THE HEAD AND NECK

Atrophic Cerebellar Lesions Shown by Encephalograms and Ventriculograms Fermo Mascherpa Radiol med (Milan) 33 62–72, February 1947

The author describes the normal encephalographic and ventriculographic appearance of the cerebellar fossa and states that too little attention has been paid to this region He discusses two cases of cerebellar cysts diagnosed radiologically and confirmed by operation and shows excellent roentgenograms

CESARE GIANTURCO, M D

Lacunar Skull (Lückenschädel) of the Newborn Report of Seven Cases. Rolla G Karshner and David L Reeves Am J Roentgenol 57 321–328, March 1947

Roentgenographically, lacunar skull is characterized by a general diminution in thickness, a variation in density, and a delay in ossification of the flat bones of the cranium It is associated usually with spina bifida and occasionally with cranium bifidum That it can occur in the absence of either of these anomalies, however, is shown by two of the authors' cases In spite of the relatively small number of reports appearing until recently, the condition obviously occurs more frequently than has been indicated and is often undiagnosed

Various pressure theories have been advanced to explain the origin of lacunar skull In view of the frequency of associated anomalies, however, it is believed that some type of chromosomal developmental defect offers a more plausible explanation All seven of the authors' patients showed congenital anomalies, including an occipital cranium bifidum and encephalocele, a thoracolumbar spina bifida and myelomeningocele, a lumbar spina bifida, porencephaly, hydrocephalus and a multilocular cyst in the anterior lobe of the hypophysis, a congenital cardiac lesion, arthrogryposis, micrognathia, and a clubfoot

CLARENCE E WEAVER, M D

Congenital Cyst of the Tongue, the Floor of the Mouth, the Pharynx and the Larynx. Gordon B New Arch Otolaryng 45 145–158, February 1947

Congenital cysts of the tongue, floor of the mouth, the pharynx, and larynx are rare but are of particular interest because of the difficulty of their diagnosis and the problem of their complete removal The cysts that must be considered are ranula, dermoid cyst, cystic hygroma, aberrant thyroglossal cyst of the tongue or of the floor of the mouth, branchial cyst of the pharynx, and laryngeal cyst

The term *ranula* has been used to designate any cyst of the anterior part of the floor of the mouth, it should be applied only to the thin-walled, epithelium-lined cyst that grows slowly, is sometimes of a bluish tinge and is soft and easily compressible The cyst fluctuates but does not pit on pressure This cystic tumor may be present at birth or may appear shortly afterward It is readily distinguished from the dermoid cyst owing to the thinness of its wall Complete removal of the cyst is the treatment of choice

Cystic hygroma is a multilocular lymph cyst which occurs primarily in the neck but may involve the floor of the mouth It has thin walls and an endothelial lining, it is usually filled with clear lymph It is a retention cyst and is due to obstruction or lack of development of afferent lymph vessels Examination discloses a smooth thin cyst in the floor of the mouth, which causes bulging of the tongue Palpation of the neck reveals an enlargement of one or both sides Lymphangioma and hemangioma of the floor of the mouth present the same clinical picture except for the color of the angioma and the granular appearance of the lymphangioma Microscopically, cystic hygroma and lymphangioma cannot be distinguished, and they react identically to radium treatment At the Mayo Clinic, nearly all cysts of this sort have been treated with external radiation or radon seeds Repeated treatment of this type causes the tumor to shrink so that there remains only a small residual thickening or some superfluous skin that may be excised

A *dermoid* cyst which involves the floor of the mouth and the submental and submaxillary regions may be situated either above or below the mylohyoid muscle or may extend from one region to the other through the muscle A large cyst causes bulging of the floor of the mouth The tongue may be back against the pharynx and may not be visible In the differential diagnosis, one must think of enlargement of the sublingual or the submaxillary glands and of a salivary calculus Repeated infection of a salivary gland may simulate the infection of a dermoid cyst except that the infected salivary gland is situated laterally, while a dermoid cyst, as a rule is located in the mid line A roentgenogram of the submaxillary region or a roentgenogram of the floor of the mouth may reveal a calculus situated mesially to the angle of the jaw Complete removal of a dermoid cyst is advisable, and the approach should be made externally or through the floor of the mouth, depending on where the largest part of the cyst is found

A dermoid cyst may also occur in the body of the tongue and a sinus may be present in the mid line of the dorsum of the tongue about halfway back Infection of the tongue frequently occurs This may cause difficulty in swallowing and eating, and the cyst may rupture If radiopaque oil is injected into the sinus shortly after rupture has occurred, the outline of the cyst may be demonstrated

An *aberrant thyroglossal cyst* may cause repeated inflammatory swelling of the base of the tongue if it becomes infected If a portion of the cyst remains below the hyoid bone it produces swelling in the neck or a thyroglossal sinus externally in the mid-line If there is incomplete obliteration of the thyroglossal duct and a portion remains in the region of the foramen cecum, repeated infection may occur In such cases if the foramen cecum at the base of the tongue is examined with a laryngeal mirror shortly after the rupture of the thyroglossal cyst an opening will be disclosed from which a small amount of mucopus is discharging After the acute symptoms have subsided, iodized oil or some other radiopaque medium may be injected into the sinus with a curved syringe to outline the tract from the foramen cecum down to, or anterior to and below the hyoid bone A roentgenogram must be made immediately after the iodized oil has been injected The treatment of this lesion consists in removing the cyst or cystic tract in the interval between infections

The *branchial cyst* may be present laterally in the pharynx in the region of the posterior pillar, or below the tonsil, or in the hypopharynx and at the base of the tongue The opening of the cyst may be enlarged under suspension laryngoscopy and the cystic tract destroyed by surgical diathermy

The *congenital laryngeal cyst* may not produce symptoms until adult life but may cause death once the larynx becomes obstructed by the mass Such cysts should be completely removed by a lateral thyrotomy Destruction of that part of the cyst which involves the inside of the larynx may entirely relieve the symptoms but may leave a cyst above and external to the thyroid cartilage, which may later cause symptoms A case is reported and preoperative and postoperative tomograms are reproduced

Dental Treatment of Trismus, Tinnitus, Otalgia and Obscure Neuralgias William J Kelly and Henry W Langheinz Arch Otolaryng 45 191–204 February 1947

The dental measures used to treat conditions producing symptoms of altered function of the temporomandibular articulation in 30 patients are described The anatomy of the articulation is not considered extensively but the authors emphasize the importance of studying the intimate relation of nearby structures and their possible involvement in condylar malposition The manner in which the mandible is attached to the skull provides obvious chances for the condyle to impinge on sensory nerve branches The most common symptoms, constituting Costen's syndrome are pain and discomfort while chewing, difficulty in opening and closing (trismus) cracking noises in the joint during movement, obscure neuralgias in and about the head, and symptoms referable to the ear such as pain, tinnitus, and deafness

Roentgenograms of the temporomandibular joint open and closed were used in this series both for determining loss of intermaxillary distance and as a routine procedure in every case In the authors' opinion, properly projected films have great diagnostic value in the analysis of Costen's syndrome, provided they are studied on a functional basis rather than as a means to determine morbid changes and alterations of contour of condyle and fossa

Evaluation of X-Ray Evidences of Sinus Disease Arthur W Proetz Canad M A J 56 183–184, February 1947

Since the nose is essentially a bony region the roentgenogram is characterized primarily by bone shadows at the same time the more delicate, the more recent, and hence the more clinically important changes can often be detected only in soft tissue shadows Most useful to the rhinologist in his daily work are the shadow outlines of the membranes If the areas are fairly large or fairly dense, or both diagnosis can be made without the aid of a radiopaque medium In the author's experience, slight differences in the membrane outlines are much better delineated by means of lipiodol or some similar contrast medium Such an examination also furnishes an index to the ability of the sinus to empty itself

In general, it may be said that an extensive thickening of a membrane, of low density and showing large convexities, denotes a recent process—an allergy or an acute infection If there is only a single large convexity and the rest of the membrane is of some other nature than a cyst is suspected Retained secretions should not be mistaken for membrane thickenings, since their outlines are not convex A shadow which is dense but not very thick and whose outline follows the bone contour indicates a hyperplasia or fibrosis of the membrane.

The emptying time is clinically important A sinus which cannot keep itself clean is always a menace. Emptying time with the commonly used solutions is approximately 96 hours For clinical purposes the 72 hour period is more practical

BERT H MALONE M D

Aerosinusitis, with Special Reference to Roentgen Diagnosis John A Cocke Am J Roentgenol 57 298–304 March 1947

The dynamics of the production of aerosinusitis may be summarized as follows At high altitude the barometric pressure falls and air escapes from the ostium of the sinus On descent, the air tends to go back into the sinus Where there is infected material in the nasal cavity, this is forced into the sinus by the increasing atmospheric pressure as the plane descends and a non obstructive aerosinusitis may result Obstructive aerosinusitis occurs when the nasal ostium of the sinus becomes covered by inflamed mucosa or redundant tissue forming a ball-valve blockage so that air cannot re enter the sinus In first- and second degree cases the roentgen findings are not characteristic, but in third degree obstructive aerosinusitis a submucosal hematoma may be demonstrable roentgenographically to suggest aerosinusitis as opposed to other sinus disease In the author's experience this type occurred usually in personnel flying above 20,000 feet

The frontal sinus is by far the most commonly affected by severe degrees of obstructive aerosinusitis. The patient usually experiences a sharp frontal pain coming on during descent There is in most cases a history of acute upper respiratory infection at the time of onset Prognosis is usually fairly good No dangerous complications occurred in the author's series

The roentgen findings are (1) hematoma, either single or multiple, in or under the mucosa of the frontal sinus (2) general clouding of the frontal sinus, (3) thickening of the mucosa of the frontal sinus, (4) evidence of antral or ethmoid disease (present in all cases except one) Because of the presence of fluid or blood in the early stage hematoma may be seen only after repeated roentgen examination In the differential diagnosis from mucous cysts the significant feature is the decrease in size of the hematoma while cysts remain stationary or enlarge over a comparable period of observation CLARENCE E WEAVER, M D

Anatomic and Radiologic Observations on the Deep Cervical Fascia. Francesco Cottoni Radiol med (Milan) 33 49–61, February 1947

The author has noticed that cold abscesses originating from the first and second cervical vertebrae tend to accumulate in front of these vertebrae instead of migrating downward In an attempt to explain this fact, he injected iodized oil in this region and found that the behavior was similar to that of the abscesses It was found that the deep cervical fascia has a firm attachment to the anterior portion of the body of the

third cervical vertebra, this attachment and the muscular insertions to the transverse processes of the third cervical vertebra hinder the downward diffusion of cold abscesses originating from the first and second cervical segments CESARE GIANTURCO, M D

THE CHEST

Staphylococcus Pneumonia in Children Roentgen Aspects. W E Anspach Illinois M J 91 75–78, February 1947

Anspach divides cases of staphylococcus pneumonia in children into two groups (1) blood-borne, following skin infections and having a rapid course, (2) bronchogenic, associated with foreign bodies in the lung or with other pulmonary diseases, as influenza, or with fibrocystic disease of the pancreas Roentgenograms of 40 young children with staphylococcus pneumonia were reviewed The characteristic roentgenological findings in cases of the bronchogenic type were accentuated hilar markings, multiple focal areas of consolidation or atelectasis, signs of local or diffuse emphysema, and abscess formation The ragged appearing bronchi with distal irregular patches of soft-tissue clouding and abscess formation aid in differentiating the disease from lipoid pneumonia, asthmatic bronchitis, and Ayerza's disease. The hematogenous type of disease shows miliary soft tissue densities throughout both lungs All of the cases in this group followed severe skin infections, usually furuncles, and death occurred before abscess cavities could be seen on chest films

The importance of fibrocystic disease of the pancreas as a cause of pneumonia in childhood is stressed Inability to gain weight, foul fatty stools, and absence of pancreatic trypsin and lipase in aspirated duodenal contents should make one suspect this condition

ROBERT C PENDERGRASS, M D

A Study of Pneumonia in Shipyard Workers, with Special Reference to Welders Morris F Collen, with the technical assistance of Martha Eaton J Indust Hyg & Toxicol 29 113–122, March 1947

An epidemiologic study was made of 2,794 consecutive cases of pneumonia in an average of 66,000 shipyard employees from September 1942 to May 1945 The diagnosis of pneumonia in every case was substantiated by indisputable physical findings and a positive chest roentgenogram Patients with pneumonia as a contributory condition to another disease were excluded The annual incidence rate of pneumococcic pneumonia for this period was 12 4 per thousand workers The relative frequencies of the various specific pneumococcic types observed were comparable to those found in other series reported from the same area The average case fatality rate for pneumococcic pneumonia for the full thirty-two month period was 5 8 per cent, for the last twelve month period it was only 1 1 per cent There was a significantly higher incidence of pneumonia in workers employed under one year The case fatality rate, however, was independent of the length of employment The generally observed fact that annual death rates from pneumonia are higher in males than females was confirmed also an increasing incidence and death rate with advancing age. No significant differences were found between the annual incidence and death rates from pneumonia for the various shipyard occupational groups studied The prognosis in welders with pneumonia was in no way different from that in all shipyard workers

Neurological Complications in Atypical Pneumonia. J MacDonald Holmes Brit M J 1 218–220, Feb 8, 1947

Two cases of "acute infective polyneuritis," two cases of lymphocytic meningitis, one of "serous meningitis," and one of encephalitis are reported occurring in association with atypical pneumonia Recovery was rapid and complete In each instance the diagnosis of atypical pneumonia was based upon the radiologic appearance ELLWOOD W GODFREY, M D

A Particular Radiologic Appearance of Hydropneumothorax. Gastone Torelli Radiol med (Milan) 33 76–78, February 1947

The author has noticed that in some cases of hydropneumothorax, the fluid does not assume a perfectly level and straight contour but presents bulges This he attributes to the formation of foam, a finding believed to be more frequent in pyopneumothorax than in simple pleural effusion CESARE GIANTURCO, M D

Pulmonary Calcifications and Sensitivity to Histoplasmin in Charleston, S C J I Waring and D B Gregg Am J Dis Child 73 139–142, February 1947

In a recent study of school children in Charleston County (South Carolina) tuberculin tests and chest roentgenograms were made on 494 children Eight children with pulmonary calcification and negative reactions to tuberculin were re-examined and each was given an intradermal injection of a 1 100 dilution of histoplasmin Of these, 5 showed a positive reaction All members of the latter group had either lived in or made prolonged visits in Kentucky, Tennessee, Alabama, or Mississippi, states which lie within the area of high histoplasmin sensitivity as determined by the United States Public Health Service From this the authors conclude that the problem of pulmonary calcification associated with sensitivity to histoplasmin is largely an imported one in their locality

Three of those sensitive to histoplasmin showed what has been regarded as a characteristic picture in such cases—multiple discrete calcifications more or less concentrated in the inner thirds of the lung fields and bilateral involvement of the hilar lymph nodes (Christie and Peterson Am J Pub Health 35 1131, 1945) In contrast, lesions of healed primary tuberculosis usually tend to be single nodules with only one lymphatic course to the hilar nodes fewer nodes are involved, and these are generally more completely calcified and larger Two children, however, who reacted positively to histoplasmin and negatively to tuberculin showed large solitary calcified nodules, indicating that a reliable differentiation cannot be made on the basis of the roentgenogram alone M WENDELL DIETZ, M D

Inherent Efficiency of the X-ray Methods Used in the Detection of Tuberculosis. Russell H Morgan Herman E Hilleboe, and Ira Lewis Pub Health Rep 62 201–211, Feb 7, 1947

The authors have attempted to settle the variance of opinion on the efficiency of certain types of film for the diagnosis of pulmonary tuberculosis by establishing

some visual standards The two principal factors studied were (1) the ability of the film to record detail of the pathologic lesions and (2) the ability of the examiner to recognize the presence of the lesion

Morgan previously studied the ability of films to record detail by radiographing a test object which produced a series of serrated patterns (Am J Roentgenol 54 395, 1945) More recently he has substituted a series of linear shadows for the serrated test object The resolving power of the film is expressed in the terms of lines per millimeter A series of roentgenograms of the chest exhibiting minimal, moderately advanced and advanced tuberculosis was studied It was found that the ability of the eye to see all types of lesions was essentially the same for 35-mm 70 mm , 4 × 5-inch and 14 × 17-inch celluloid films, and 14 × 17 inch paper films at a distance of 1 meter Above this distance there was a sharp drop in the ability of the eye to detect the lesions and this drop was most marked in cases of minimal tuberculosis

Films of high contrast were less subject to error in reading than those with low contrast In the case of paper films, where the contrast is approximately 40 per cent that of 14 × 17-inch celluloid films, the loss of contrast would be important

The authors also demonstrated that low contrast lesions, such as are seen in minimal tuberculosis, have a contrast value on the fluoroscopic screen of approximately two thirds of that of the images on 14 × 17-inch films The greatest error lay with the observer, reaching approximately 40 per cent in detecting minimal tuberculosis by fluoroscopy This was further checked by a series of fifty patients with minimal tuberculosis and the diagnostic error, fluoroscopically, was 31 per cent

[The above study appears to be based on unbiased data dealing with film quality and the ability of the eye to observe lesions at various distances The factor of recognition of the lesion was fairly well eliminated by the use of three independent trained observers A critical analysis such as this should stimulate community surveys with the smaller size of films, provided a trained radiologist interprets them It should also discourage a spreading tendency in some quarters to depend upon fluoroscopy for the detection of minimal tuberculous lesions R C P]

ROBERT C PENDERGRASS, M D

The Dust Hazard in Tremolite Talc Mining Leonard Greenburg Yale J Biol & Med 19 481–501, March 1947

A study of the tremolite talc mining and milling industry in northern New York State is reported Talc in this region is of the asbestine variety, mingled with tremolite and anthophyllite Analyses of material from both mines and mills gave consistently a free silica content of 1 per cent or less Microscopic studies of dust showed the presence of fine, straight, needle-like fibers

Upon the initial roentgen survey in 1940, fibrosis was observed in 32 of the 221 men examined (14 5 per cent) These 32 cases, with one exception in men forty years of age or older, were all found among a group of 107 who had worked in talc for ten years or longer, an incidence for this group of 29 9 per cent Of 8 men who had worked thirty or more years in talc, 6 showed fibrosis (75 per cent)

From the occupational history it was learned that 18 of those with fibrosis had not worked in any other dusty industry and therefore their only significant dust exposure had been to talc Fifteen of the men showing fibrosis worked in the talc mills 3 were miners The proportion of mill workers to miners in the entire group, however, was approximately 2 3 to 1, showing that fibrosis was relatively more prevalent among millers than miners Thirteen of the 18 had one or more symptoms referable to the lungs, 10 complained of dyspnea, 7 of chronic cough, 3 of pain in the chest In addition, 5 complained of excessive fatigue. On physical examination all 18 showed limited chest expansion. Thirteen had abnormal lung signs, 13 curving of the nails or clubbed fingers 1 cardiac hypertrophy, and 1 auricular fibrillation

The type of fibrosis seen in the roentgenograms is very fine and diffuse showing in many instances an appearance of soft haziness to which the term "ground glass," used in describing certain cases of asbestosis, can well be applied In a number of cases there is in addition a distinctly granular appearance, and in some a nodulation which might be confused with silicosis In certain films soft conglomerations also occur The fibrosis in these cases tends to be somewhat more marked on the right side and in the mid lung fields and bases The hilar nodes show a slight or moderate increase in density Evidence of obliterative pleuritis and emphysema occurs in some cases In a few instances a blurring or 'shagginess" of the cardiac outline is noticeable

In the total group of 221 talc workers there were 29 cases (13 1 per cent) of primary healed tuberculosis, 6 (2 7 per cent) of healed re-infection type tuberculosis, and 5 (2 2 per cent) which were considered, on the basis of the roentgen findings alone, to show clinically significant tuberculosis The incidence of healed primary and re infection type lesions is not remarkable in any way, being similar to that found in other industrial groups The incidence of clinically significant tuberculosis is slightly higher than found in most industrial groups (2.2 and 1.2 per cent, respectively) Clinically significant tuberculosis was diagnosed roentgenologically in 3 of the 18 cases of fibrosis

In addition to fibrosis, deposits of unidentified opaque material in the periphery of the lungs, including the region of the diaphragm and pericardium, designated as "talc plaques " were observed in 6 3 per cent of all tremolite talc workers examined These deposits occurred independently of other lung lesions and could not be identified with any particular signs or symptoms

Technique of the Roentgenologic Demonstration of Pulmonary Infarcts. Laurence L Robbins Am J Roentgenol 56 736–742, December 1946

Pulmonary infarcts vary from a small, thin lesion lying against the pleura to large lesions occupying the greater portion of a lobe The shape is variable, depending upon the location but the infarct is always peripheral its long dimension lying parallel to the pleura An infarct is at first indistinct gradually becoming more sharply circumscribed Later it assumes a linear shape and finally may disappear except for a thin linear scar

Certain special technical procedures are of value in the demonstration of infarcts and in their differentiation from other pathological conditions The chest examination should include roentgenoscopy unless the patient's condition forbids This will show the position and

motion of the diaphragm The leaf of the diaphragm which underlies an infarct in the inferior portion of a lobe is usually elevated and splinted A small amount of fluid, often the first sign, may also be detected more easily by roentgenoscopy than on the film The spot roentgenogram taken during roentgenoscopy is often of value, affording a better opportunity for study than the routine large film Additional roentgenograms made in at least two planes should be obtained High-kilovoltage technic is recommended to obtain greater latitude in the films A six foot distance with short exposure time is most desirable Films made with the portable unit are usually not diagnostic of small infarcts Bronchography and laminagraphy were not of value in the author's experience, for demonstrating pulmonary infarcts, and in most instances the patient is too ill to stand the manipulation required for these procedures H H WRIGHT, M D

Clinical and Roentgenologic Aspects of Coccidioidomycosis. Charles F Sweigert, John W Turner, and James B Gillespie Am J M Sc 212 652–673, December 1946

The authors discuss at some length the clinical aspects of coccidioidomycosis The usual initial endemic infection is respiratory, incurred by inhalation of chlamydospores in contaminated dust It may be asymptomatic and in most instances subsides spontaneously and without sequelae Its occurrence may be indicated by a positive coccidioidin test or, less frequently, by residual pulmonary lesions demonstrable roentgenographically The most frequent clinical form of the disease is an acute self limited respiratory infection manifested as a bronchitis pleuritis, or pneumonitis which is clinically indistinguishable from the usual non-specific upper respiratory infections

In 13 per cent of the cases in the authors' series the primary infection resulted in apparently benign persistent residual pulmonary lesions such as cavities or nodules, unaccompanied by constitutional signs or symptoms Rarely, the initial infection becomes progressive, with widespread lymphatic and hematogenous dissemination Any organ system may be involved except the digestive tract, and the symptoms will vary with the dominant localization This phase which usually takes place within weeks or months, represents a continuous progression of the primary infection

Thoracic pain, which is the most frequent and often the predominant symptom, occurs in about 80 per cent of the cases Fever was present in most of the authors' patients sometime during the illness, but about 40 per cent were afebrile despite other signs and symptoms The fever in the disseminated cases persisted for months Less than half of the patients had a significant cough Sputum was usually scant, and examination for the organisms was usually unsatisfactory Cutaneous eruptions occurred in about 18 per cent of the cases A less well defined erythema was more frequent than the typical erythema nodosum

In the absence of cutaneous manifestations physical findings are of little or no diagnostic help in the acute primary infection In the disseminated cases unusually extensive lymphadenopathy may occur The leukocyte count is usually moderately elevated and there may be eosinophilia of 10 per cent or more The sedimentation rate the most useful single index of activity will be elevated in nearly all of the cases

Roentgenologically, coccidioidomycosis may simulate various types of acute pneumonic lesions in its earlier phase, and lymphoma and primary or metastatic carcinoma in its later stages Bone lesions, which are part of the disseminated form, may resemble any destructive lesion, principally tuberculosis

In a small group of patients, roentgenologic findings may be absent In the primary phase there may be only a slight increase in the size of the hilar shadows on one side or, with greater involvement, several small parenchymal infiltrations Massive lobar infiltration is rare. Partial resolution is the rule during the early weeks The hilar or mediastinal adenopathy becomes more apparent at the time the pulmonary infection begins to recede, and is no indication of dissemination

Necrosis may occur within a resolving infiltration, forming a thin walled cavity The cavities, in contrast to those of tuberculosis, tend to form in areas other than the upper lobes Nodules developing at the site of previous infiltrations may disappear after a time, or may be replaced by thick-walled round cavities Calcific stippling frequently occurs in the nodules Diffuse pleural thickening associated with pneumonitis is a common finding, but effusions are unusual

Dissemination occurs in less than 1 0 per cent of the patients Nodules, cavities and adenitis of the late primary phase are not to be confused with the disseminated disease In the latter form, miliary distribution may occur, skeletal lesions may be multiple, involving bone and cartilage, meningitis is a common occurrence

A diagnosis of coccidioidomycosis can be made with reasonable certainty if there is a history of recent residence in an endemic area, if an acute upper respiratory infection is present, with or without erythematous cutaneous lesions, and if there is a positive coccidioidin cutaneous or serologic test An initially negative skin test with a subsequent positive test is conclusive evidence of a coccidioidal infection

There is no specific treatment for the disease Symptomatic care is indicated The treatment of cavities is still unsettled BENJAMIN COPLEMAN, M D

Clinical, Radiological and Pathological Aspects of Pulmonary Haemosiderosis (Symposium) L D W Scott S D Scott Park, and Alan C Lendrum Brit J Radiol 20 100–107, March 1947

Hemosiderin may be deposited in the lungs in any condition causing pulmonary hemorrhage, but radiologic demonstration of the deposits appears to be limited to children with a severe anemia and to occasional cases of mitral stenosis The roentgen ray appearance as observed in the latter condition is that of a fine mottling most pronounced in the middle zones of the lungs, remaining unchanged over a period of months Autopsy studies show these small densities to be due to hemosiderin lying in cells gathered in clumps in the alveoli of the lung SYDNEY J HAWLEY, M D

Airblock in the Newborn Infant. George W Salmon, Gilbert B Forbes and Harbert Davenport J Pediat 30 260–283, March 1947

The term airblock describes the condition produced by the escape of air from the normal respiratory pathways into tissues in which it is not normally present It has been postulated that such air first passes through multiple minute ruptures of the alveolar walls which

border upon blood vessels, to reach the mediastinum Further dissemination may result in cervical subcutaneous or retroperitoneal emphysema and pneumoperitoneum Also the air may travel from the mediastinum into the interstitial tissue of the other lung, rupture into the pericardial sac, or rupture the mediastinal pleura to enter the pleural sac Interstitial pulmonary air can produce pneumothorax by either of two mechanisms (*a*) rupturing the visceral pleura directly or (*b*) first producing mediastinal emphysema and then rupturing the mediastinal pleura Factors requiring further investigation include the possibility of pulmonary interstitial emphysema producing air embolism and also cor pulmonale

The incidence of pulmonary interstitial emphysema (the first step in the production of airblock) is undoubtedly higher than is commonly believed It may result from alveolar over-inflation as in the compensatory emphysema associated with atelectasis and reduction in the caliber of the pulmonary blood vessels, as with pulmonary stenosis and embolism

In the presence of interstitial emphysema, the size of a pneumothorax may have no relationship to its pressure Although the pneumothorax may be under a very high tension, the lung may be prevented from more than a moderate collapse by the splinting effect of the interstitial emphysema

If a pneumothorax is present an apparent substernal collection of air in a lateral roentgenogram is not diagnostic of mediastinal emphysema This may be explained by assuming a herniation of the anterior mediastinum, particularly if the pneumothorax is under tension

The paper reviews previous reports on the subject and presents the postmortem findings in 6 cases

M WENDELL DIETZ, M D

Roentgenologic Findings in Myasthenia Gravis Associated with Thymic Tumor C Allen Good Am J Roentgenol 57 305–312, March 1947

Good made a study of 100 consecutive cases of myasthenia gravis observed at the Mayo Clinic since July 1, 1941 Roentgenologic examination in each instance included a postero-anterior roentgenogram of the thorax and either a lateral roentgenogram or a fluoroscopic study, or both In 17 of the cases, evidence of a mass in the anterior mediastinum was found at one or more of the roentgen examinations Eleven of the 17 cases in which a mass was demonstrated by the roentgenologist were explored, and in all a tumor was found Ten were said by the pathologist to be thymic tumors while the other was presumed to be the necrotic remains of a thymic tumor In 3 cases the presence of a thymic tumor was proved at autopsy

In five of the 17 cases the postero-anterior roentgenograms showed no evidence of a mass Roentgenoscopy or lateral roentgenograms disclosed these tumors Roentgenoscopic examination demonstrated a tumor in 11 of the 15 cases in which it was performed A tumor may be overlooked when it is shaped like a plaque and is closely attached to the anterior pericardium and the great vessels

Thymic tumors are usually located in the upper part of the anterior mediastinum but may be situated lower in the thorax Calcification can occur A tumor in the anterior mediastinum in a case of myasthenia gravis is most likely to be thymic in origin

Roentgenoscopy is the most important part of the examination Particular attention should be directed to the cardiovascular shadows in both oblique projections, where an abnormal convex shadow may be seen The round tumor of the anterior mediastinum is usually not difficult to demonstrate.

CLARENCE E WEAVER, M.D

The Cardiopathy of Sickle-Cell Anemia and Its Differentiation from Rheumatic Carditis. Barbara Cutting Halpern and Harold K Faber J Pediat. 30 289–294, March 1947

It is often difficult to differentiate between rheumatic heart disease and the cardiac manifestations of sickle-cell anemia. Certain characteristics have been described which make the correct diagnosis possible.

1 The two diseases rarely occur in the same patient

2 Though the history in both diseases is similar (both show fatigability, failure to gain weight, dyspnea, and pains in the extremities) the pain of rheumatic fever is found in the joints while that in sickle-cell anemia occurs over the long bones However, the authors do not think this is often a helpful diagnostic point

3 The response of the pain to salicylates is not as great in sickle-cell anemia.

4 The physical findings of jaundice, lymphadenopathy, hepatomegaly leg ulcers, and enlarged spleen characterize sickle-cell anemia.

5 Diffuse cardiac enlargement and a greatly prolonged P-R interval are more characteristic of sickle-cell anemia. [In a study of a large series of cases of sickle-cell anemia now being made by the abstractor the P-R interval has always been within normal limits]

6 The sedimentation rate is rapid in rheumatic fever and slow in sickle-cell anemia

After presenting the above diagnostic criteria, the authors report a case of cardiopathy in a 12-year-old colored girl who had been followed for three years. During this time she had been treated for rheumatic fever with heart disease and an associated sickle-cell anemia She had marked thickening of the cranial vault and a large cardiac shadow was apparent on x ray study On several occasions after her discharge from the hospital, the child voluntarily returned to the clinic requesting blood transfusions whenever anorexia, irritability, and extreme fatigue developed The heart had grown progressively larger during the follow up period The case is reported to illustrate the criteria listed above. STANLEY H MACHT, M D

Lutembacher's Syndrome Complicated by Acute Bacterial Endocarditis Report of a Case Diagnosed During Life Arthur J Geiger and Harold C Anderson Am Heart J 33 240–249 February 1947

The association of a large interauricular septal defect with a mitral stenosis is known as Lutembacher's syndrome. The authors observed a case of this type in a white woman first seen at the age of forty-four and kept under continuous observation for eleven years During the course of a routine employees' examination a diagnosis of hypertensive cardiovascular disease was made. Five years later the patient was re-examined because of occasional headaches associated with vomiting The electrocardiogram revealed prolonged A V conduction right axis deviation abnormally tall, broad

and notched P waves, and slurring of QRS complexes A roentgen examination demonstrated marked enlargement of the left ventricle with prominence of the pulmonary conus and arteries A diagnosis of a patent ductus arteriosus and interventricular septal defect was ventured

Three years after this, a lobar pneumonia occurred and the patient was hospitalized for eleven days During this period there was moderate cyanosis, which subsequently disappeared Ectopic ventricular beats were also detected Two years later medical care was sought because of fatigue Pulmonary infiltration was evident on physical and roentgenographic examinations Other symptoms developed, and the patient was again hospitalized She was acutely ill but not cyanotic Electrocardiograms revealed a sinus rhythm, prolonged A-V conduction time, abnormally broad and notched P waves, frequent ectopic ventricular beats, right axis deviation abnormal slurring of QRS complexes in limb leads, and flat T wave in Lead 1 A positive blood culture, pneumococcus type V, confirmed a suspicion of acute bacterial endocarditis The course in the hospital was brief Death occurred on the fourth day with evidence of embolic phenomena

The final diagnosis was acute bacterial endocarditis complicating a congenital cardiac anomaly consisting of a large interauricular septal defect with associated mitral stenosis The authors discuss the clinical phases which prompted this diagnosis and include postmortem findings by which it was confirmed

HENRY K TAYLOR, M D

Amoebic Pericarditis M L Edwards M J Australia 1 177–178, Feb 8, 1947

The rarity of amebic pericarditis prompted Edwards to report the following case

A 44-year old Australian soldier was admitted to a field hospital in New Guinea on May 10, 1945, with a one week history of right subcostal pain radiating to the neck, which was aggravated on deep respiration Physical examination was entirely negative except for mild evening pyrexia Ova of *Ankylostoma duodenale* were found in the stool and a routine vermifuge administered The patient's initial symptoms persisted and on the ninth day following admission, a pericardial friction rub was heard over the base of the heart down to the left fourth intercostal space A blood count and chest film were normal The pericardial rub persisted and on June 2, the pain in the right hypochondrium began to radiate to the right shoulder

The patient was evacuated to the mainland on June 9 with right hypochondrial pain as the cardinal symptom Physical examination as well as cholecystography were negative An electrocardiogram revealed left axis deviation, but was otherwise within normal limits Symptoms of diaphragmatic irritation increased and a chest film on July 18 showed a rounded localized elevation of the right diaphragm adjacent to the cardiophrenic angle The white blood count at this time was elevated with a normal differential Although no amebae or cysts were found in the stool, empirical administration of emetine was started On July 23 the patient began to raise purulent blood-stained sputum and signs of patchy consolidation were found in the right lower lobe associated with a pleural friction rub X ray examination of the chest showed an opacity in the right lower lobe superjacent to an area of localized elevation of the mid portion of the diaphragmatic leaf Prominent vascular markings extended from the opacity to the hilum These findings were interpreted as indicative of rupture of a liver abscess through the diaphragm with residual pneumonia and pleuritis

The patient's convalescence was uneventful and x ray studies on Oct 3 revealed only slight pleural thickening

The author's conclusions are that the initial pericardial signs were due to pericardial irritation produced by underlying amebic infestation of the liver with subsequent spontaneous rupture of an abscess through the diaphragm LOUIS BERNSTEIN, M D

THE DIGESTIVE SYSTEM

Limitations of Roentgenology and Gastroscopy in the Diagnosis of Diseases of the Stomach Analysis of Fifty-Three Proven Cases Edward B Benedict Gastroenterology 8 251–277, March 1947

Benedict presents a study of 53 cases of proved gastric disease illustrating the limitations of gastroscopy and radiology in the differential diagnosis of benign and malignant lesions of the stomach The cases were divided into separate disease groups and analyzed from that standpoint

In 19 proved cases of gastric carcinoma, x ray and gastroscopy were correct in 10 instances Both were incorrect in only one case Nine cases are presented in abstract form giving both gastroscopic and x ray findings and illustrating the limitations of x-ray and the gastroscope The author does not believe that gastroscopic examination is usually indicated when the diagnosis of carcinoma is obvious roentgenologically The gastroscope should be used where diagnosis is difficult and to aid the roentgenologist in the examination of doubtful cases

In 21 cases of proved benign gastric ulcer the radiologist and gastroscopist were correct in 8 instances and in 5 both were incorrect The unfavorable comparison with the carcinoma group may be due to (1) apparent nodularity of severe gastritis surrounding the ulcer site, suggesting carcinoma, (2) rigidity of the wall in the region of the benign ulcer, also suggesting carcinoma, (3) tendency of both the radiologist and gastroscopist to prefer erring on the side of carcinoma Twelve of the 21 cases were abstracted and studied Mechanical failure accounted for 5 of the 6 cases in which gastroscopy was of limited value The x-ray was found to be limited in 2 cases in which gastroscopy was more accurate

Two cases of jejunal ulcer are included in the series Gastroscopy was a mechanical failure in one In the other a marginal ulcer had the gastroscopic appearance of a carcinoma

Five cases of gastritis were studied In this group both methods of examination were incorrect in one case, in another case gastroscopy was of the more limited value and in 2 cases x ray examination proved to be more limited Each case was explored surgically

In 2 cases of benign tumor, x ray and gastroscopy were right in one instance and in another gastroscopy led to a diagnosis of multiple polyps which were not demonstrated by x ray

A case of gastric lymphosarcoma is presented illustrating the limitations of both x ray examination and gastroscopy In this instance the gastroscopist placed lymphoma among the first diagnostic possibilities

A normal posterior gastro-enterostomy stoma was studied radiologically as well as with the gastroscope The question of an antral neoplasm was first raised by the x ray findings but later both the roentgen and gastroscopic studies demonstrated a normal functioning gastro-enterostomy stoma

Two normal stomachs were included in this study In one both diagnostic procedures were correct and in the second a lesion in the fundus of the stomach was suggested by the roentgenologist Gastroscopically a neoplasm in the blind area of the fundus could not be ruled out Exploratory operation was negative

Summarizing the results in all the groups, one finds that both methods furnished a correct diagnosis in 21 cases, both were wrong in 8, the x ray was more accurate in 11, and gastroscopy was more accurate in 13 In 8 of the cases the gastroscopist was limited by mechanical difficulties The author feels that, if the gastroscopist can get a good view of the lesion, he has a better chance of making a correct diagnosis than the radiologist The two methods of examination are supplementary and not at all competitive In a good number of instances greater diagnostic accuracy can be obtained if both are used co-operatively

WILLIS MANGES M D

Coexistent Duodenal Ulcer and Gastric Malignancy Albert Fischer, O Theron Clagett, and John R McDonald Surgery 21 168–174, February 1947

From June 1911 through January 1945, 48 patients with coexistent duodenal ulcer and gastric carcinoma, proved at operation or necropsy, were seen at the Mayo Clinic All but 4 of the carcinomas were verified histologically During the period covered by this study 45,000 cases of duodenal ulcer and 13 000 cases of carcinoma of the stomach were seen

A roentgen diagnosis of coexistent lesions was made in 22 of the 46 cases examined roentgenologically The gastric lesion was missed in 5 of the forty-six the duodenal lesion was missed in 11 The various roentgen diagnoses were carcinoma of the stomach and duodenal ulcer, 16 cases, gastric ulcer and duodenal ulcer 6 cases, carcinoma of the stomach, 7 cases gastric ulcer, 5 cases, duodenal ulcer, 3 cases, pyloric obstruction, 1 case, lesion at outlet of stomach, 2 cases, prepyloric lesion, 1 case, hypertrophic gastritis and duodenal ulcer, 2 cases, obstruction of the lower part of esophagus, deformity of cardia, 1 case, negative 2 cases

At operation, only 4 cases of subacute or perforating duodenal ulcer were seen From the surgical descriptions, the remainder were assumed to be chronic or healed ulcers, and it is suggested that they may have been modified by the presence of the superimposed gastric lesions In tissues obtained postmortem, one chronic duodenal ulcer was found while in two cases scars furnished the only evidence of ulcer [Why the authors use the term 'coexistent" when the only evidence of ulcer was a palpable scar is not clear —J E W]

Twenty-nine patients had symptoms of peptic ulcer for more than five years preceding discovery of the malignant lesion In 10 cases, the initial symptoms were those of carcinoma of the stomach In the remaining 9, since most of the ulcers were inactive presumably the ulcer antedated the carcinoma

In 24 cases a definite change in character of symptoms occurred, in 15 cases there was a change in the degree of symptoms, in 7 the symptoms were progressive, and in 2 no change in symptoms was noted Changes in symptoms included (1) diminution of relief from food, (2) cessation of periodicity of symptoms, (3) shift in location or extension of pain, (4) sensation of rapid filling of the stomach, (5) hemorrhage, (6) abdominal tenderness, (7) palpable abdominal mass The average duration of symptoms was 11 3 years varying from three days to forty six years.

There was no correlation between levels of gastric acidity and nature of the peptic lesions No explanation could be derived as to why patients with duodenal ulcers seldom have malignant lesions of the stomach.

Twelve patients were alive more than five years after the diagnosis of coexistent cancer and ulcer, 2 were alive twenty and twenty-one years, respectively The high survival rate may be explained by the fact that duodenal ulcer patients are "stomach conscious" and seek medical help earlier

J E WHITELEATHER, M.D

Intestinal Obstruction of the Newborn. A Report of Five Patients Successfully Relieved by Surgery Alfred D Biggs and Guy V Pontius J Pediat 30 306–316, March 1947

The diagnosis of intestinal obstruction of the newborn rests largely on two important symptoms The first is persistent copious bile-stained non projectile vomiting, beginning usually on the first day of life. Abdominal distention is the second cardinal symptom. It may be accompanied by deep peristaltic waves, especially in atretic cases

In the authors opinion, the flat film usually yields the desired information The barium sulfate meal is regarded as unnecessary, dangerous, and a cause of delay The need for early operation cannot be overemphasized

Two cases of extrinsic intestinal obstruction are presented One was secondary to a firm globular, enteric cyst lying in the left upper quadrant, not connected with the lumen of the bowel Operation on the second patient demonstrated almost complete obstruction of the cecum and terminal ileum due to fibrous bands

In 2 of the remaining 3 cases of bowel atresia reported a celiac like syndrome developed postoperatively Addition of concentrated pancreatin to the formula appeared to be a material aid in combating this condition

M WENDELL DIETZ M D

Amebiasis A Roentgen Study of Relatively Early Gastrointestinal Findings Philip J Hodes and Lambert Mammoser Am J Roentgenol 57 329–332, March 1947

Ninety-two patients, 60 who passed cysts but had no symptoms and 32 with amebic dysentery, were examined by roentgen methods in an American hospital in the China-India-Burma theater of war The authors believe that in no case was the disease of more than eight months' duration In all patients with amebic dysentery and 7 asymptomatic cyst passers barium studies of the small intestinal tract were made. All 92 patients had barium enema examinations In 28 patients with amebic dysentery, abnormalities in the small bowel were found In all but one of the asymptomatic cyst carriers the small intestine was normal. In 21 cases there was unusual hypermotility of the small intestine, the barium entering the cecum in approximately one-half hour Five others showed barium in the cecum in less than one and one half hours. The

small intestinal pattern was usually normal A few patients showed decreased tone Nothing significant was observed in the terminal ileum

Not infrequently the oral meal revealed an irritable non retentive cecum which looked normal by barium enema study This suggests that the oral method is a more reliable indication of an irritable cecum in early amebic typhlitis

Barium enema study of 32 patients with amebic dysentery revealed irritability of the cecum in 7 cases, 25 cases showed no significant findings, but double contrast studies were not made routinely Of the 60 asymptomatic carriers, only 10 showed changes which seemed significant These changes included increased tone or irritability in the region of the cecum, ascending colon, descending colon, or sigmoid

CLARENCE E WEAVER, M D

Duplication of the Rectum (Enterogenous Cyst or Diverticulum) H D Cogswell and Hugh C Thompson, Jr Am J Dis Child **73** 167–174, February 1947

Because of the rarity of duplications of the alimentary tract, especially the rectum, this case of an enterogenous cyst or diverticulum is reported Such hollow structures possess a muscular coat and are lined with epithelium similar to that found in some portions of the gastro-intestinal tract They may arise in any part of the tract and may be either antimesenteric or mesenteric in their location They may occur in the subserous or the submucous layers of the bowel wall and their shape may be tubular or globular The muscular coat is usually adherent to the muscularis of the alimentary tract and the duplication may or may not communicate with the adjacent lumen In the latter case, the contents of the duplication will be similar to those of the neighboring bowel Those without a communication to the lumen are cystic

The symptoms are those of obstruction of the alimentary tract by extrinsic pressure, pain from distention of the cystic structure, and hemorrhage because of interference with the intestinal blood supply resulting in necrosis

Roentgenologic observations are valuable in establishing the diagnosis In the reported case anteroposterior and lateral films showed an air-containing cyst arising from the left side of the pelvis A barium enema study revealed displacement of the sigmoid and descending colon to the right A lateral view showed the splenic flexure and transverse colon to be posterior to the cyst The communication between the cyst and the colon could not be demonstrated The case was unusual in that it assumed the characteristics of both a cyst and a diverticulum during the month while the child was under observation The relatively quiescent gas filled tumor became grossly infected and caused sudden symptoms The relief of the acute symptoms was effected by marsupialization of the duplication and this procedure is recommended by the authors for cases of this type

STANLEY H MACHT, M D

Amebic Liver Abscess in Service Personnel L Kraeer Ferguson and Robert Kent Anderson Gastroenterology 8 332–342 March 1947

Hepatic abscess of amebic origin should be encountered with increasing frequency in service personnel who have seen duty in areas where amebiasis is endemic The diagnosis is not always easy, since the demonstration of amebae in the stool may be difficult, the history indefinite, and the interval between dysentery and abscess long The clinical signs, in the order in which they appear, are general malaise and loss of appetite, leading to a progressive loss of weight and a moderate anemia Gradually, pain appears in the upper right abdomen and hepatic tenderness is found on examination Intermittent fever is the rule, usually between 99° and 101° F in uncomplicated abscesses but rising to 103° or 104° F in the presence of secondary infection Chills are likewise suggestive of secondary infection, and the leukocyte count, usually low in simple amebic hepatitis and abscess, may rise to 20,000 to 30,000

Roentgen examination is helpful in arriving at a diagnosis, especially in those cases in which the abscess is located in the dome of the liver Elevation of the right leaf of the diaphragm, but without complete loss of diaphragmatic motion, is usual with simple amebic abscess Elevation with loss of diaphragmatic motion and pleural reaction above the diaphragm may indicate secondary infection of the abscess or perforation into the subdiaphragmatic space Abscesses arising deep in the right lobe or presenting on the lower surface of the liver do not show the characteristic unilateral diaphragmatic elevation

Emetine and aspiration may be tried, in the order named, in non-infected abscesses Drainage is indicated for abscesses which are secondarily infected It should be preceded by or combined with emetine and penicillin therapy Four case reports are included in the paper to illustrate the difficulties of diagnosis

BERT H MALONE, M D

A Clinical Consideration of the Malfunctioning Non-Calculus Gall Bladder Maurice Feldman Am J Digest Dis 14 53–56, February 1947

A sluggish emptying gallbladder is rather common in patients with gastro-intestinal symptoms It was observed 75 times (19 per cent) in 396 consecutive patients with digestive complaints in the author's experience, whereas the incidence in an asymptomatic group was only 10 per cent

When to classify a gallbladder as pathological on the basis of delayed emptying has never been definitely determined One must be cautious in recommending surgery in these cases Eight of the author's series were operated upon and in 7 of these a normal gallbladder was found, in the eighth a band of adhesions was present between the gallbladder and pylorus

Normally the gallbladder begins to empty three to five minutes after a fat meal The gallbladder contracts and the sphincter of Oddi, which regulates the passage of bile into the duodenum, relaxes Among possible factors causing delayed emptying are thick mucus or thick bile muscular changes or adhesions, spasm and reflex nerve dysfunction endocrine changes, and drugs (morphine)

The normal gallbladder concentrates dye in twelve to twenty hours Its average size is 3 8 × 7 9 cm , after a fat meal it will shrink to an average of 2 4 × 6 8 cm In over 75 per cent of persons the organ is pear shaped In a small percentage it is tubular The average size of the sluggish emptying gallbladder was found to be 4 4 × 8 0 cm and following a fat meal 3 9 × 7 5 cm

In a study to compare the complete emptying time of normal as compared to sluggish emptying gallbladders it was found that in almost all of the normal cases

emptying was complete in five hours, whereas most of the sluggish emptying gallbladders were still filled after eighteen hours JOSEPH T DANZER, M D

Incomplete Removal of the Cystic Duct as a Factor in Producing Postcholecystectomy Complications N Frederick Hicken, L B White, and Q B Corry Surgery 21 309–320, March 1947

Annoying biliary dysfunction persisting after cholecystectomy is often attributable to an irritative focus located in the residual stump of the cystic duct Incomplete removal of the duct along with the diseased gallbladder may be followed by the so called "reformed gallbladder," actually a dilatation of the duct stump by secretory pressure from the liver, or by persistent external biliary fistulas In addition, stones may be present in the stump, and may protrude into the common duct or, becoming dislodged, may occlude the ampulla of Vater A long residual duct may become adherent at such an angle that cicatricial contraction results in an occlusive kinking of the common duct

Such postoperative sequelae may be minimized, according to the authors, by restriction of elective operations on the gallbladder to those surgeons familiar with variations in the biliary duct system, removal of the gallbladder and the entire cystic duct whenever cholecystectomy is done, establishment of the functional integrity of the common duct and the hepatic bile ducts before closing the abdomen

Abnormalities of the cystic duct can be detected accurately by cholangiography on the operating table This is accomplished by injection of 70 per cent diodrast into the gallbladder prior to dissection of the duct system As the gallbladder and associated biliary radicals will be filled with the contrast medium, an accurate roentgen pattern of their size, shape, and relationships will be obtained The demonstration of anomalies and non-palpable stones will aid the surgeon in the operative procedure

Excellent reproductions of cholangiograms, drawings of some of the anomalies of the cystic duct and their relations to the common duct, and illustrative case histories are included J E WHITELEATHER, M D

Disseminated Calcification of the Pancreas, Subacute and Chronic Pancreatitis C Wilmer Wirts, Jr, and William J Snape Am J M Sc 213 290–299 March 1947

In disseminated calcification of the pancreas a variable portion of the parenchyma of the gland is replaced by calcium deposits, while in the usual form of pancreatic lithiasis the ducts contain single or multiple stones While the incidence of lithiasis is generally considered to be less than 1 0 per cent, Lüdin (Arch f Verdauungskr 63 273, 1938) found an incidence of 5 5 per cent on dissecting postmortem specimens after preliminary roentgenography

Disseminated calcification is thought to follow repeated attacks of acute or subacute pancreatitis, possibly following the onset of the disease in childhood Grossly, the gland is firm, containing firm white calcareous bodies The finer ducts are dilated and may contain small stones Extensive intra- and interlobular fibrosis is seen microscopically These cases may be related to chronic cystic fibrosis of the pancreas in children or to a syndrome occurring in pancreatic atrophy associated with fatty degeneration of the liver

Most of the reported cases have been in males, with an average age of about thirty eight years The outstanding complaint is some form of abdominal pain over a period of years or months, traced back, in some cases, to childhood The pain is usually gnawing and boring in character, most frequently in the epigastrium and radiating to the back Steatorrhea or creatorrhea and transient jaundice are found in 25 per cent of the cases Pancreatic secretion is absent or diminished The stool may be large, mushy, and formless, containing increased fat when steatorrhea is present During acute episodes the urine may contain albumin and the serum amylase may be elevated There may be some bromsulfalein retention and an increase in the alkaline phosphatase activity

The typical roentgenogram shows a diffuse stippled calcification involving all of the pancreas The degree of calcification cannot be correlated with the severity of the symptoms A typical deficiency pattern may be seen in the small bowel following a barium meal

This condition may simulate any other abdominal disease, but it is usually confused with cholecystitis. The clinician should always rule out disease of the pancreas when deep seated epigastric pain is associated with mental symptoms

The relief of the acute symptoms usually requires morphine When the condition is advanced, the treatment may require a low-fat high-calorie, high vitamin diet and large doses of pancreatin The surgical removal of large stones has not materially altered the course of the disease in disseminated calcification BENJAMIN COPLEMAN, M D

THE MUSCULOSKELETAL SYSTEM

Dysplasia Epiphysialis Multiplex Thomas Fairbank Brit J Surg 34 225–232 January 1947

The author describes what he believes to be a clinical entity under the title dysplasia epiphysialis multiplex, and attributes it to a developmental error of unknown origin The condition is characterized by dwarfism, stubby digits, and mottling or irregularity in density and outline of several of the developing epiphyses, and it lacks the other abnormalities of the skeleton necessary for its allocation to one of the well recognized disease groups

The features of this form of epiphyseal dysplasia as found in a series of 20 cases, are as follows It affects children and young people of both sexes, the age range in the series reported being from six to over forty years It is not inherited or familial Difficulty in walking was present in 8 cases, and in 5 cases there were pain and stiffness of the knees or hips Some degree of dwarfism, of the short-limb type, is the rule This was found in 16 cases The appearance of the hands is striking, the fingers and thumbs being short, thick, and stubby with blunt ends Various other deformities were found, but none of these was considered characteristic

The essential abnormalities are in the epiphyses the ossification centers are late in appearing and backward in development, and fusion with the shafts may be delayed The epiphyses are irregular in density and shape, mottled, and perhaps mulberry like in outline. Peripheral stippling is occasionally seen There is a definite tendency toward improvement, but although the epiphyses become normal in density the outline remains permanently abnormal Any of the epiphyses may be affected but those most commonly affected are the hips shoulders, ankles and less frequently the

knees The humeral and femoral heads remain permanently shallow The ankles show changes of diagnostic value The lower tibial epiphyses diminish in depth from within outwards with a resulting oblique joint space and corresponding deformity of the trochlear portion of the astragalus The upper epiphysis of the humerus, the capitellum and the distal radial epiphysis show changes in some cases, but no permanent deformity in the elbows and wrists was noted The metaphyses show no characteristic or consistent change The shafts of the long bones are often shorter than normal The metatarsals, metacarpals, and phalanges are stunted The spine, skull, and teeth showed no abnormalities

In the differential diagnosis cretinism is the first general condition to be excluded The classical signs of this are absent and there is no response to appropriate therapy In dysplasia epiphysialis punctata the whole of an epiphysis seems to be ossifying from a large number of discrete centers, the shafts of the long bones are short and thick, the tarsal bones may be completely stippled, and the abnormalities are much more gross than in most cases of the multiplex group In chondro-osteodystrophy of the Morquio Brailsford type the acetabula are markedly enlarged and irregular, the notable feature is the kyphotic deformity in the dorso-lumbar region and the shape of the vertebral bodies In dyschondroplasia there is gross abnormality of the metaphyses and the distribution is usually unilateral In osteopoikilosis and osteopetrosis the changes in the shaft dominate the picture Mottled epiphyses have been found in pituitary gigantism and in other endocrine disturbance Finally, if there is reason to suspect pseudo-coxalgia, it is worth while to examine shoulders and ankles to exclude epiphyseal dysplasia multiplex

MAX CLIMAN, M D

A Case of Polyostotic Fibrous Dysplasia of Bone J P Lanigan, T G Hardman, and J D H Widdess Irish J M Sc , February 1947, pp 71–73

The authors recount a typical case of polyostotic fibrous dysplasia of bone as originally described by Albright in 1937 The main features of the syndrome are (*a*) bone lesions of the fibrocystic type, which have a marked tendency to be unilateral, (*b*) brown pigmented areas of skin, which tend to be on the same side as the bone lesions, (*c*) endocrine dysfunction, which in females is associated with precocious puberty

The authors' patient was a five year-old girl A biopsy was done and photomicrographs of the specimen are reproduced, together with roentgenograms and photographs of the patient

Infantile Cortical Hyperostoses Report of a Case Richard K Whipple *New England J Med* **236** 239–242, Feb 13 1947

In July 1945 a new syndrome entitled infantile cortical hyperostoses" was presented (Caffey and Silverman Am J Roentgenol 54 1 1945 Abst in Radiology 46 538 1946) of which the principal features are onset early in the first year of life, tender swelling of the face jaw, scapular region, and extremities and scattered hyperostoses in the bone demonstrable by radiography

The case here recorded is that of a three month old boy with a swelling in the right side of his jaw first thought to be a parotitis The swelling was tender, vomiting occurred occasionally, but there was no fever The blood count showed 68 per cent hemoglobin and 24,000 white cells Early films of the skull and rest of the skeleton revealed no definite changes, but three weeks later lesions were demonstrable in the right mandible suggesting an infectious process, osteomyelitis, or sarcoma Infantile cortical hyperostosis was then thought of and the films were sent to Dr John Caffey for interpretation He reported a mandibular hyperostosis with thickening of the ramus, body, coronoid process, and articular process, together with external hyperostoses of both parietal bones and cortical thickening of the right clavicle

The patient now ran an intermittent fever as high as 102 5° F , which neither penicillin nor sulfadiazine seemed to influence

At a later date scattered patches of thickening of both internal and external plates were seen in the parietal and occipital bones, diffuse general enlargement of the entire mandible without destruction, thickening of both clavicles, thickening of the 3d, 4th, and 5th left ribs and of the right and left 9th, 10th, and 11th ribs The spine, pelvis, and long bones appeared normal

The findings in this case are consistent with the earlier description of infantile cortical hyperostoses The disease presents a favorable prognosis, although the outcome in this case was not determined at the time of report

JOHN B MCANENY, M D

X-Ray Appearances in Chronic Rheumatism. George D Steven Ann Rheumat Dis 6 1–14, March 1947

The roentgenographic appearances of rheumatoid arthritis, osteoarthritis, and gout are described, with a brief discussion of the differential features in a number of other diseases

Rheumatoid Arthritis The early changes of active disease (presumptive) are (1) osteoporosis of generalized type affecting all the bones of the skeleton, producing an exaggerated contrast in shadowing between the shafts and ends of bones, (2) spindle shaped swelling of soft tissues around the affected finger joints, and possibly slight increase in the joint space from effusion The established changes of active disease (typical) are (1) an increase in generalized osteoporosis producing a distinctive local pattern in the more vascular areas, (2) diminution of cartilage of uniform character, (3) localized osteoporosis affecting the articular cortex of some joints, (4) erosion of articular cortex and underlying spongiosa, especially at the articular margins, with a localized osteoporosis in the eroded trabeculae. Late changes of chronic or quiescent disease (obscured) are (1) return to normal contrast between spongiosa and compact bone but with recovery of the bone density rarely complete, (2) maintenance or increase in the loss of cartilage, remaining uniform in character, (3) irregular new bone covering the eroded trabeculae, reconstructive changes with cystic enclosures, and greater density in the ends and shafts of bones where articular surfaces are eroded, (4) subluxation, especially ulnar deviation of the fingers, (5) ankylosis, especially across gliding joints destroyed by erosion, (6) spiky lipping at the articular margins and scanty sclerosis of secondary osteoarthritic type.

Osteoarthritis The earliest change (presumptive) is osteophyte formation of beak shaped type at the place of insertion of capsular ligaments to joint margins Established changes (typical) are (1) loss of cartilage of

a one sided character, resulting in faults in bone position or alignment and corresponding shift in lines of stress, (2) osteophyte formation at margins where stress is increased, with either imperfect attempts at bone bridging or outgrowths in the direction of the plane of the joints, (3) separate ossicles in the middle of capsular ligaments in some interphalangeal joints, (4) hypertrophic bone outgrowths of terminal phalanges (Heberden's nodes), (5) osteosclerosis in subarticular bone, and coarsening of trabeculae along lines of stress Late changes (obscured) are (1) gross loss of cartilage, (2) eburnation, with pitting of articular surfaces, (3) subarticular cystic degeneration, (4) subluxation

Chronic Gout Early changes (presumptive) are (1) hazy soft-tissue shadowing affecting bone detail and contrast (out of-focus appearance), (2) local soft-tissue swellings at joints (not fusiform) Established changes (typical) are (1) osseous tophi—subchondral, endosteal, and medullary—and predilection for the articular margin, with erosion of the articular cortex, (2) loss of cartilage, formation of articular tophi, and subperiosteal outgrowths, at margins of tophi, (3) osteosclerosis, usually wavy and irregular, and irregular calcium deposits in bone. Late changes (obscured) are (1) osseous tophi walled in by compact bone, and coarse wavy buttressing with pinhead and honeycombed translucencies, (2) secondary osteoarthritic changes, (3) ankylosis in some joints

A standard radiograph of the hands is recommended as a general routine measure for diagnostic purposes Roentgenograms are reproduced

Renal Osteodystrophy James S Norman Robert Perlman, and Stephen Bastable. J A M A 133 771–773, March 15, 1947

The study of a white soldier twenty years of age with renal osteodystrophy, or renal rickets was undertaken because of unusually prominent clavicles The patient showed a chronic uremic state with azotemia and hyperphosphatemia The roentgenographic changes demonstrated were mild osteoporosis, stippling of the skull delayed ossification at the epiphyseal cartilages in some areas, slipped humeral epiphyses, metaphyseal erosion, palisade-like periosteal new bone formation, and calcification of the media of arteries Several reproductions of roentgenograms fail to show clearly the changes described

E M WRIGHT, M D
(University of Michigan)

Roentgen Diagnosis and Therapy of Bone Tumors Ad Liechti Schweiz med Wchnschr 77 216–223, Feb 8, 1947

This is a general review of the diagnosis and treatment of bone tumors The author places special emphasis on the impossibility of making a diagnosis of the anatomico-pathological type from the roentgenograms No new material is presented

LEWIS G JACOBS M D

Eosinophilic Granuloma of Bone Report of a Case with Multiple Lesions of Bone and Pulmonary Infiltration Albert Weinstein, Herbert C Francis, and Bertram F Sprofkin Arch Int Med 79 176–184 February 1947

This is a report of a case of multiple bone lesions and pulmonary infiltration The authors point out that approximately 30 cases of eosinophilic granuloma have been reported in the medical literature, but that at times it has been called 'solitary granuloma of bone.' In the case recorded here the original complaint was headache Roentgenograms of the skull showed two bony defects and a fine nodular type of infiltration was demonstrable in the lungs A diagnosis of eosinophilic granuloma was suggested and the pathologic diagnosis was established on a lesion in the skull Subsequently lesions were discovered in the third lumbar vertebra, in the ilium and around the symphysis pubis Symptoms—pain and cough—receded following irradiation. A dose of 1,500 r produced a regression of the multiple lesions in the pelvis and lumbar spine The thorax (anterior and posterior) received 600 r Other courses of therapy given to the mandible and a lesion of the right ilium, amounting to 400 and 500 r, respectively, also produced regression and symptomatic relief

The authors are unable to state with certainty that the pulmonary lesions in this case were actually a visceral manifestation of the disease, but they consider it entirely possible, though no such case has been previously reported In support of their view they point out the similarity of Letterer-Siwe's disease, the Hand Schüller-Christian syndrome and eosinophilic granuloma and reprint the following tabulation from Mallory (New England J Med 227 955, 1942)

I Letterer-Siwe's disease (Reticuloendotheliosis, aleukemic reticulosis, non-lipid histiocytosis)
Children under two years
Fever, skin rash, anemia, purpura, splenomegalia
Histologically proliferation of monocytes and clasmatocytes in bone, skin, lymph nodes, and spleen, with or without deposits of lipids

II Hand-Schüller-Christian syndrome
Older children
Defects in cranial bones, exophthalmos diabetes insipidus
Xanthoma deposits with or without eosinophils
Associated lymph nodes may show typical eosinophilic granuloma, with or without deposits of cholesterol

III Eosinophilic granuloma
Children and adults
Single or multiple lesions of bone
Good general health low grade fever, leukocytosis with eosinophilia, local tumor, sometimes painful
Histologically granuloma with eosinophils
Cured by local excision, roentgen rays, or occasionally healing spontaneously

SYDNEY F THOMAS M D

The Changing Concept of Myeloma of Bone Ernest Aegerter and Robert Robbins Am J M Sc 213 282–289, March 1947

The present concept of multiple myeloma admits that the tumor may possibly arise from extramedullary sources that it is probably not of single-cell origin, that it may have a single focus for a considerable period or may be so diffuse that no localized foci are apparent, and that it may consist of other than plasma cells

The classical type is characterized by multiple tumors occurring predominantly in flat bones and exclusively where red marrow is found Because of the remarkable lytic action of the tumor on bone the diagnosis may often be made on roentgenographic examination of the flat bones

The tumor may begin as a single focus and remain thus limited for a long time All completely studied cases, however, have eventually shown multiple lesions The tumor may be so generalized that all red marrow is affected simultaneously, producing generalized skeletal demineralization and profound changes in the peripheral blood These cases may be misdiagnosed as senile osteoporosis on roentgenographic examination

Another type of tumor, better called a myelocytoma, is almost always confined to the soft tissues

The cytogenesis of myeloma is poorly understood There are two clearly defined types plasma-cell myeloma and Ewing's tumor A considerable number of the other types can be differentiated by means of their cytologic character It is agreed that these tumors arise from marrow elements Marrow smears may show nearly identical tumor plasma cells even though tissue sections from the tumors may be different

Many patients with myeloma show signs and symptoms of renal insufficiency, the exact cause of which is still not agreed upon Bence-Jones protein may be derived from the myeloma cells and/or the normal marrow cells The association of increased plasma globulin and the presence of abnormal numbers of plasmocytes is encountered in other diseases Bence Jones protein is either not as commonly present as earlier studies would indicate, or it may be transient and missed

If a myeloma lesion is single, a needle biopsy may be a valuable source of information Bone pain invariably occurs as the first symptom In many instances roentgenographic procedures will first suggest the true nature of the disease A diagnosis of senile osteoporosis should not be relied on without the aid of a marrow study

BENJAMIN COPLEMAN, M D

Myelosclerosis with Leukoerythroblastic Anemia. Marcy L Sussman Am J Roentgenol 57 313–320, March 1947

Nine cases are reported and illustrated in which myelosclerosis was demonstrated roentgenologically in instances of leukoerythroblastic anemia The roentgen appearance is at first that of trabeculae which are wider and denser than normal This is followed by the deposition of bone in an irregular fashion throughout the marrow so that the entire medullary cavity becomes denser and the endosteum merges into the marrow Most bones excepting those of the skull show these changes There is no periosteal reaction

Myelosclerosis may be interpreted as part of a syndrome representing a single disease which might be classified as atypical myelogenous leukemia In most cases, regardless of onset, the anemia finally becomes progressive increasing leukoblastic activity appears and ultimately death occurs with leukemic invasion of the spleen and other organs Differentiation from other conditions such as fluorine poisoning prostatic metastases Hodgkin's disease and certain stages of lipogranulomatosis is not difficult when full clinical data are available CLARENCE E WEAVER, M D

Sarcoma in Abnormal Bones. Harry Platt Brit J Surg 34 232–239 January 1947

Of a series of 161 tumors of bone belonging to the sarcoma group, 18 were found to occur in abnormal bone 10 occurred in Paget's disease 2 arose in fibrocystic disease, and 6 represented malignant transformation of a previously benign osteochondroma

The Paget sarcomas were found in patients over fifty years of age and the bones involved were the femur, humerus, and pelvic bones The histologic type of tumor in all cases was a spindle or polymorphic sarcoma In 7 of the 10 cases, death resulted within a year One patient only, with a sarcoma of the humerus, has survived two years from the time of operation

The two cases of sarcoma arising in a focal area of fibrocystic disease developed after comparatively long intervals The first patient had a large cyst of the ilium at the age of eighteen He was under observation for seven years and the final radiograph showed complete destruction of the bony pelvis on the right side At autopsy microscopic examination revealed spindle-cell sarcoma, there was no trace of secondary deposits elsewhere The second patient, a man aged thirty-eight, had a cyst in the upper end of the humerus which ten years later began to behave as a tumor and was found at biopsy to be a fibrosarcoma The patient was alive nine years after disarticulation

The recognition of malignant change in a chondroma or osteochondroma can be difficult, especially in tumors with a long history later growing to an enormous size Rapid growth and large size are not in themselves criteria of malignancy, but a presumed benign osteochondroma which begins to increase in size should be removed before it reaches the stage of malignant transition MAX CLIMAN M D

Diffuse Osteoid Replacement of the Bone Marrow Report of Case Emil Maro Schleicher Am J Clin Path 17 216–221, March 1947

A case of 'diffuse osteoid replacement of the bone marrow" in a 73-year-old woman is presented The patient was admitted to the hospital in March 1945 with lobar pneumonia and a severe anemia and died two days later She had been hospitalized in 1938 with a Colles s fracture, from which she recovered without complication No anemia was present at that time On the last admission the essential laboratory data were as follows hemoglobin 8 0 gm per 100 c c , erythrocytes 2 700 000, leukocytes 13,600, with neutrophils 67, lymphocytes 12, monocytes 5 eosinophils 3, basophils 1, metamyelocytes 8 neutrophilic myelocytes 3, reticulocytes 1 One normoblast was observed per 100 leukocytes The mean corpuscular diameter of the erythrocytes was 7 6 microns Because of the unexplained anemia a sternal aspiration was performed but no marrow tissue could be aspirated A small core of marrow tissue, obtained by a method described in detail by the author, consisted of several fragments of osteoid fibrous tissue, some erythroid and myeloid cells and fat At autopsy, specimens were taken from various long bones all of which could be cut easily with a knife with the exception of the femurs Serial sections showed the cortex to vary in thickness, the bone trabeculae in some areas were thicker than normal and closely spaced whereas in other areas they were normal in size and spacing Osteoid tissue was scattered throughout the medullary cavity, the amount varying considerably in the individual sections taken from a single bone Sections of the femur showed osteoid islets of various sizes, a conspicuous quantity of fat some hematopoietic islets, and a small amount of fibrous tissue. All other bones showed areas of marrow hyperplasia alternating with areas of various degrees of hypoplasia and fatty metamorphosis

The appearance of the bones in the roentgenogram was that of senile osteoporosis"

The author suggests a genetic relationship between diffuse osteoid replacement of the bone marrow and Albers Schönberg disease In Albers-Schönberg disease, (1) endochondral ossification is disturbed as soon as bone formation begins, (2) there is continuous production of true bone, thickening of bone trabeculae and production of fibrous tissue (3) there is loss of elasticity of the bones causing brittleness, (4) finally, the progressive thickening of the cortex and encroachment on the medullary cavity by newly formed bone make for the extreme hardness and characteristic opacity of the bones in the roentgenogram In the present instance, however, (1) osteoid tissue and not true bone replaced the marrow substance (2) the appearance of the bones in the roentgenogram was that of "senile osteoporosis," (3) the bones could be cut easily with a knife In view of the fact that osteoid fibrous and lipoid tissue replaced the marrow, and that this process apparently caused no specific clinical symptoms, the case presented here may be considered as a heretofore unrecognized mild form of Albers-Schönberg disease

The value of intravital bone marrow studies and the importance of keeping in mind primary diseases of the bone marrow in obscure and refractory anemic states are emphasized

Spondylosis and Spondylarthritis J Borak Ann Int Med 26 427–439, March 1947

The intervertebral disk undergoes definite changes in the course of life The nuclear substance, normally soft like jelly, becomes gradually firm and dry due to a process of dehydration Coincidentally the elastic elements of the disk are replaced with fibrous tissue. This chain of events is called degeneration of the intervertebral disk In about 20 per cent of cases a thinning of the disk results, causing a narrowing of the intervertebral space, recognizable roentgenographically This is due to the fact that the cartilage has no power of regeneration Instead the rupture of the cartilage plates stimulates the adjacent vertebral bodies to produce new periosteal bone having the appearance of marginal spurs A spur up to 1 cm in length may develop within the first year after which the growth continues at a very slow rate

These marginal spurs appear to be a reparatory reaction of the vertebral bodies to the degeneration of the intervertebral disks As an answer to the flattening of the disk the spurs tend 'to provide a wider articular surface" in the transverse and sagittal direction and thus to restore the weight bearing capacity of the spinal column

There is a widespread inclination to hold spurring responsible for numerous clinical symptoms The only cases in the author's experience, however, in which marginal spurs as such gave rise to clinical symptoms were those in which large spurs located on the anterior surface of the cervical spine caused symptoms of dysphagia due to their close vicinity to the esophagus In another group of cases, reported in the literature, spurs growing into the spinal canal gave rise to neurological symptoms but this is exceptional Similarly the flattening of the intervertebral disk in the course of the aging process is painless giving rise to no symptoms, since no nerves are present in the disks

The marginal spurring in the spine described above has sometimes been designated hypertrophic spondylarthritis but this term is open to several objections To denote these abnormal findings the term spondylosis has been used marginal spondylosis if spurs are present at the edges of the vertebral bodies, destructive spondylosis if a narrowing of an intervertebral space also is present It may be emphasized that a narrowing of an intervertebral space in the absence of pronounced marginal spurs is not characteristic of spondylosis but is rather suggestive of a protrusion of the nucleus pulposus if it occurs in the lower cervical or lower lumbar spine.

In a minority of the cases, approximately 10 per cent of the patients showing spinal spurs, these findings are not due to the aging process but to other factors, such as deformities injuries infectious and neoplastic disease As a rule, however, such spurs are limited to one area, and are often solitary The roentgenograms usually also disclose the underlying pathological condition

Two main types of chronic spondylarthritis may be differentiated, rheumatoid and osteoarthritic

Rheumatoid arthritis of the spine, also called Marie-Strümpell s spondylitis, predominantly affects young men It is a systemic disease which, if not arrested, steadily progresses in the ascending direction until all intervertebral joints eventually show osseous ankylosis Decalcification of the vertebral bodies and calcifications of the spinal ligaments accompany the more advanced stages of the inflammatory process in the joints The blood sedimentation rate is, as a rule, increased.

Osteoarthritis of the spine is a disease of the middle and advanced age groups It affects equally both sexes It is a monoarthritic or oligoarthritic condition The lower portions of the cervical, thoracic and lumbar regions of the spine are the sites of predilection. Osteoarthritis of the spine never causes an osseous ankylosis The calcium content of the vertebrae is within normal range except in very old persons, where it is reduced The sedimentation rate of the red blood cells is normal.

Swelling of the joints, a finding so valuable in the diagnosis of arthritic conditions in other locations, cannot be noticed in the spine because the joints are covered by many layers of thick muscle. In both types of spondylarthritis there are backache limitation of motion, pain radiating into the limbs, and tenderness on pressure to one or both sides of a spinous process, corresponding to the joints affected Radiographically osseous ankylosis is characteristic of rheumatoid arthritis marginal spurs, sharpening and thinning of the facets of osteoarthritis Otherwise, the difference between the two types is not very pronounced

No marginal spurs or narrowing of the intervertebral spaces occur in the rheumatoid type of spondylarthritis. The contrary is true of osteoarthritis Out of 43 cases with radiological signs of osteoarthritis, only 8 showed no signs of spondylosis This frequent coexistence suggests the possibility that spondylosis may be a factor in the development of spondylarthritis It seems probable that the majority of the patients with a narrowing of an intervertebral space are likely sooner or later to develop osteoarthritis of the apophyseal joints

STEPHEN N TAGER, M D

Rheumatoid Spondylitis A Study of 1,035 Cases. Howard F Polley and Charles H Slocumb Ann Int Med 26 240–249, February 1947

A series of more than 1,000 cases of rheumatoid spondylitis at the Mayo Clinic was analyzed as to sex,

age, onset, symptoms, and course The data were confirmatory of what is known Of chief interest is the following evaluation of the x ray findings

Roentgenologic evidence of rheumatoid spondylitis may be lacking if the progress of the disease has not resulted in destruction of cartilage and subchondral bone When present, the characteristic findings are arthritis of the sacroiliac and apophyseal joints, calcification or ossification or both of spinal ligaments, and osteoporosis of vertebrae The so-called bamboo spine has in the past been regarded as the characteristic roentgenologic evidence of rheumatoid spondylitis, but the changes in the sacroiliac joints are equally characteristic and occur much earlier The involvement of the sacroiliac joints is typically bilateral In this study bilateral sacroiliac arthritis occurred in 98 per cent of the cases

Arthritis of apophyseal joints undoubtedly occurs as a significant part of the disease process, though it is often difficult to demonstrate roentgenologically Calcification of spinal ligaments may be present at the time of the first symptoms, but usually is demonstrable only after months or years of the disease

The ligamentous changes seen in rheumatoid spondylitis are generally distinct and not to be confused with osteoarthritis of the spinal column A calcified spinal ligament is seen in one of the authors' illustrations as a thickening of homogeneous density superimposed on the surface of the vertebra and spanning a normal intervertebral space The osteophyte of osteoarthritis, by contrast shows a variation in density, and cortex and cancellous bone may at times be as clearly differentiated as in the body of the vertebra

Unilateral sacroiliac arthritis suggests the presence of a specific infectious disease, such as tuberculosis, but it may occur infrequently in rheumatoid spondylitis It was noted in 6 cases in this study

Absence of roentgenologic evidence of involvement of the sacroiliac joints is unusual in rheumatoid spondylitis but it does occur It was found in 9 cases in the present series STEPHEN N TAGER, M D

Ruptured Intervertebral Disk in the Cervical Region Report of Twenty Cases Frederic V Kristoff and Guy L Odom Arch Surg 54 287–304, March 1947

The authors recognize two stages of intervertebral disk protrusion, depending on the degree of herniation In the first there is root compression only, in the second root and cord compression are combined

The objective signs of root compression may be divided into mechanical defensive signs (tilted head, wryneck, tenderness on compression) and neuropathologic signs (hypotonia, weakness, fibrillation and muscular atrophy) The latter only are localizing in nature While the diagnosis is primarily clinical, plain roentgenograms may show narrowing of the involved interspace absence of the normal lordosis, and on oblique views arthritic changes and narrowing of the intervertebral foramina Determination of the level involved requires myelography in all cases Differential diagnosis must include cervical arthritis scalenus anticus syndrome, laminar fracture of the cervical spine, cervical rib (or elongated transverse process of C-7), subdeltoid or subacromial bursitis brachial neuritis, Pancoast tumor and cervical radiculitis

In the case of cord compression the syndrome is that of cord tumor and diagnosis may be made only at operation

The operation for cervical disk rupture is similar to that done for disk rupture in other locations, but is somewhat more risky In 16 cases showing pure root compression the result was uniformly good, in the 4 with combined cord and root compression recovery was not as spectacular nor as complete

LEWIS G JACOBS M D

Cleidocranial Dysostosis with Psychosis Samuel Kilgore and G W Lasker Arch Neurol & Psychiat 56 401–416, October 1946

The authors describe a typical case of cleidocranial dysostosis but point out that one may find clavicular anomalies with no alteration of the skull and that in various cases all manner of congenital bony anomalies may be present or any of them may be lacking There have been approximately 275 publications on the condition (A complete bibliography is to appear in a paper by Lasker, scheduled for publication in *Human Biology*)

The authors' patient was a 31-year-old male whose peculiar physical appearance contributed significantly toward the development of an associated schizophrenia The patient's history and the findings on examination including a detailed account of the psychiatric findings, are presented It is stated that from a psychiatric standpoint persons with cleidocranial dysostosis might almost represent a cross section of the general population In only three cases, besides the authors', was there an associated psychosis It is concluded that in the few persons with mental disease no constant relationship to the dysostosis has been established

A K BUTLER, M D
(University of Michigan)

Scheuermann's Disease (Vertebral Epiphysitis) A P Lachapèle and C Lagarde J de radiol et d'électrol 28 10–23 1947

The authors begin with a thorough historical survey of vertebral epiphysitis and mention those whose contributions have been notable Numerous illustrations are included showing the fragmentation and indentation of the epiphyseal plates which are familiar to most radiologists, as well as the improvement which follows orthopedic correction of the kyphosis, which seems an invariable feature of the condition

While the authors do not go far in presenting their own idea of etiology, their work cannot but suggest it to those whose experience with this entity is at all extensive They do stress the fact that inflammatory changes are not satisfactorily demonstrated in the epiphyseal plates (and study of specimens has obviously not been extensive, since they naturally do not come to the pathologist except under unusual circumstances) With evidence lacking of specific primary changes in the plates, and abundant evidence that change of posture arrests the process quite promptly, the conclusion rather thrusts itself upon one that posture may be nearly if not entirely responsible for this 'epiphysitis"

The illustrations in this article do not look greatly different than the dorsal spines we have become accustomed to seeing in the quest for causes of painful backs save that the epiphyses are somewhat fragmented, with density changes If the dorsum rotundum habitus becomes marked at just the age when these epiphyses are separate and rather vulnerable, they take the brunt of the disk pressure and suffer accordingly, if this habitus

is delayed for a few years we see merely the postural deformity, then, if it continues, we begin describing "osteoarthritic changes in the dorsal spine, with anterior lipping," which represents the result of the flexion posture in a later age group A concomitant may be disk damage, with 'Schmorl's nodes," seen at various ages These impressions are quite noticeable in the illustrations here, in several cases

Years of observation tend to clear away much confusion in many clinical entities, where, before there had been opportunity for adequate x-ray study, a number of etiologic factors were invoked for syndromes essentially the same A good example is the once mysterious Kümmel's disease, which is now rather generally regarded as an overlooked compression fracture

From the standpoint of a historical review as well as a thorough survey of the literature the article is particularly recommended PERCY J DELANO M D

Osteomyelitis of the Sphenoid Bone Report of a Case with Complete Recovery Kenneth M Kahn Arch Otolaryng 45 348–351, March 1947

The author presents a case of chronic suppurative fronto-ethmoiditis with chronic osteomyelitis of the frontal and sphenoid bones, secondary to multiple shell fragment wounds resulting in bleeding from the portion of the internal carotid artery contained within the cavernous sinus The diagnosis was made clinically and roentgenologically and was substantiated by microscopic observations Adequate surgical intervention and massive penicillin therapy were instituted early Ligation of the internal carotid artery was finally required to control hemorrhage, there were no manifestations of cerebral atrophy following this procedure. The thirty four million units of penicillin given to prevent intracranial disease produced no toxicity The patient was well at the time of the report, with roentgen evidence of bone repair in an area known to be osteomyelitic

Preoperative and postoperative roentgenograms in various projections are reproduced, presumably illustrating the case

Heberden's Nodes VI. The Effect of Nerve Injury upon the Formation of Degenerative Joint Disease of the Fingers Robert M Stecher and Louis J Karnosh Am J M Sc 213 181–191, February 1947

Heberden's nodes are enlargements of the terminal interphalangeal joints due to degenerative joint disease The fingers are usually involved bilaterally Although susceptibility to this condition depends on genetic and constitutional factors, clinical evidence indicates that the nodes develop only in a hand which has an intact nerve supply The lesion fails to develop, or is retarded in its progress, in the presence of peripheral nerve damage, spinal cord disease, or palsies of cerebral origin

Degenerative joint disease is thought to be due to deficient or decreased circulation The prevention of Herberden's nodes has been associated with a nerve injury or a lesion in the central nervous system affecting the vasomotor mechanisms in the paralyzed areas, producing increased blood circulation and resultant osteoporosis

Three cases are described and nine cases from the literature are discussed

BENJAMIN COPLEMAN, M D

Tuberculous Dactylitis in Childhood A Prognosi Janet B Hardy and John R Hartmann J Pediat 3(146–156, February 1947

The authors report 21 cases of tuberculous dactylit complicating primary tuberculous infections in chil hood Although tuberculous lesions of the small bon of the hands and feet are rather rarely encountered th analysis merits attention because it re emphasizes th remarkable spontaneous healing of even advance destructive lesions The follow-up of the childre surviving averaged eleven years

Seventy-six per cent of the patients were Negroes an 67 per cent were under two years of age when the com plications occurred The dactylitis was either the pre senting complaint or an early sign in 19 of the 21 case studied The local clinical picture was essentially th same in those with severe generalized infection and i milder cases without extensive pulmonary lesions

From accompanying roentgenograms, the author describe the varied forms dactylitis may assume Minimal medullary changes, periosteal and cortical re duplication, and "ballooning with generalized destruc tion are well illustrated The bones of the hands were found to be much more frequently affected than those o the feet The primary and most extensive lesion was usually located in the diaphysis

In view of the excellent prognosis for complete healing with return to normal contour, the authors believe surgical procedures are contraindicated Treatment in their series consisted of immobilization with incision and draining of those lesions secondarily infected.

M WENDELL DIETZ M D

Osteitis Pubis After Suprapubic Operations on the Bladder, with a Report of Ten Cases E Kirz Brit J Surg 34 272–276, January 1947

The author found 6 verified cases of osteitis pubis in a follow up of 174 cases in which suprapubic operations on the bladder had been performed during the past three years The diagnosis is made by symptoms, physical findings, and x-ray examination Severe pain in the region of the symphysis three to six weeks after operation suggests the possibility of osteitis pubis The pain extends to the perineum and may radiate down to the inner side of one or both thighs Motions of the thighs are painful, and walking is difficult There is extreme tenderness on pressure over the symphysis and pubic rami The muscles arising from that part of the pelvis are spastic and may later show great wasting

Roentgenograms may at first show no change. Later the first signs of rarefaction appear at the medial portion of both corpora pubis A well established case will show a definite spread involving variable amounts of pubic bone and ischium The cartilage at the symphysis may be absorbed and finally bony ankylosis may result Formation of a sequestrum is rare, but areas of osteoporosis and osteosclerosis are seen later These may suggest metastatic growth but this can be eliminated by periosteal new-bone formation resulting in osteophytes and bony spurs, associated with the disappearance of symptoms

Two main factors appear to be essential in the production of the infection (1) leakage of infected urine into the retropubic space, (2) trauma both during and after operation The author is inclined to believe that trauma inherent in the classical suprapubic approach is the main cause of osteitis pubis

MAX CLIMAN M D

Adamantinoma in the Tibia. Béla Halpert and H Phillip Dohn Arch Path 43 313–317, March 1947

An epithelial anlage tumor—adamantinoma—of the tibia, proved by biopsy, in a 24-year old white woman is reported This is the nineteenth recorded instance of such a growth of the tibia Roentgenograms showed an osteolytic mass which had destroyed approximately 12 cm of the distal shaft of the bone There was expansion of the bony cortex, with only a thin shell remaining The fibula and the ankle joint appeared intact Chest films showed no osseous or soft-tissue involvement

Recurrent Dislocation of the Patella Frederick R Thompson and David M Bosworth Am J Surg 73 335–339, March 1947

Recurrent dislocation of the patella always occurs to the lateral side of the joint The patella slips over the lateral femoral condyle causing the clinical appearance of a very prominent medial femoral condyle Although trauma plays a part in initiating the dislocation, the authors are of the opinion that the recurrent cases have a primary basic underlying fault permitting dislocation to occur In many of the cases roentgen examination reveals an underdevelopment of the lateral femoral condyle a flattening as compared with the normal probably congenital In one family in the authors' series there appeared to be a pronounced hereditary tendency for recurrent dislocation of the patella among the female members As in congenital dysplasia of the hip it is probable that underdevelopment of the femoral condyle is present in varied degrees in both sexes

Since dislocating patellas are much more frequently seen in females the authors suggest the wisdom of considering this condition whenever a suspected medial meniscus injury is observed in a female A torn medial meniscus is rather rare in women

Genu valgum enhances the tendency to dislocation by altering the pull of the patellar tendon lateral to the mid line of the femur, and also because it causes stretching of the medial capsular ligaments and promotes lateral mobility of the patella

In some cases there is an associated change in the shape of the patella with the patella being pear shaped, pointed at its lateral margin An associated osteoarthritis has been observed in older cases, occasionally with evidence of loose bodies

The most informative roentgenogram is one taken with the patient prone and the knee flexed

The history of the operative technic for recurrent dislocation is reviewed The authors agree with Hauser's observations reported in 1938, that the patella not only rides higher on the femur than normally but that the patellar tendon is lengthened They have accordingly followed Hauser's technic with slight modification They believe that simple transplantation of the tibial tubercle medially and slightly distally with division of the medial and lateral capsule of the knee joint satisfactorily controls recurrent dislocation The transplanted tubercle is fixed in place with a three-hole plate and screws Little or no postoperative plaster support is indicated

DAVID S MALEN M D

Neuropathic Foot Lesions in Diabetes Mellitus. C Cabell Bailey and Howard F Root New England J Med 236 397–401 March 13 1947

Joint changes associated with central nervous system diseases were first described by Charcot They are usually found in tabes dorsalis, syringomyelia, leprosy, and injury to peripheral nerves Similar lesions have been reported as occurring in diabetes mellitus

This report deals with 17 patients with neuropathic foot lesions from about 20,000 consecutive cases of diabetes The usual change is swelling over the dorsum of the foot without evidence of inflammation The changes are slow, with thickening and deformity of the foot, eversion and external rotation, and flattening of the longitudinal arch The radiographic changes are limited to the tarsal and metatarsal region The characteristic change is a fragmentation and destruction of the metatarsal and tarsal bones The joint spaces disappear and there is a loss of continuity of the individual bones Fracture may occur There is a complete loss of normal bone structure with numerous bone spicules scattered throughout the area of involvement The lesion is both productive and destructive

The evidence of neuritis consists in absence of the knee jerk foot drop, anesthetic foot loss of sensation to pain and vibration, bladder paralysis, and paresthesias of the lower extremities The acute onset of fluid in the joints and swelling with pain in the early stage will tend to differentiate the Charcot joint from the diabetic neuropathic foot The Charcot joint of the foot is unusual, but a neuropathic foot is not unusual in diabetes Other symptoms found and laboratory findings will help in differentiation

JOHN B MCANENY M D

GYNECOLOGY AND OBSTETRICS

Standardised Radiological Pelvimetry I. Quantitative Aspects II Qualitative E Peter Allen Brit J Radiol 20 45–54, February 1947, 108–118, March 1947

A standardized system of roentgen pelvimetry should be capable of measuring all significant pelvic diameters it must utilize standard apparatus be capable of accurate description be reasonably simple and provide a basis for morphological classification In addition it should be sufficiently concise and intelligible so that inexperienced radiologists and obstetricians may use it with confidence. This study, from New Zealand, is based upon a review of the literature and personal observations on over 400 primiparae and measurements on 12 anatomical specimens (10 of native Maoris and 2 of white women) The first paper, to be followed by three more is mainly concerned with an examination of the differences in a quantitative aspect, of the systems of pelvic measurement now in use

The author stresses the point that there should be no relaxation of a high standard of accuracy Not only should the pelvic brim be measured but also the lower pelvis and the fetal head The measurement of diameters in planes other than the sagittal should not be dependent upon the identification of external bony points as such identification is apt to be faulty and to introduce unpredictable errors Hodges and Dippel s (Internat Abst Surg 70 421, 1940) recommendation of sagittal plane diameters measured from the single lateral roentgenogram by an isometric scale and other pelvic diameters and fetal measurements studied in stereoscopic films made with the patient on her back with a pad beneath the lumbar spine is considered acceptable for a standard method

It is just as important to determine what diameters to measure as to determine how to measure them There is

little difference of opinion so far as diameters in the coronal plane are concerned The two always measured are the transverse of the brim and the bi spinous Others which may be added are the bi-tuberous, the anterior and posterior transverse of the brim, and the transverse of the mid plane All of these except the bi-tuberous and the anterior transverse have clearly defined end-points

Sagittal plane diameters can be measured by one of several methods The major problem to be decided is the status of the obstetrical true conjugate of the brim The posterior end point of the true conjugate is hard to locate Not all methods use the same end-point The transverse of the inlet does not always lie in the same plane as the true conjugate as measured The erection of perpendiculars at the intersections of these diameters is therefore an artificial procedure The factor which determines the "least" conjugate is the pubosacral angle When this angle is a right angle, the promontory of the sacrum is closest to the symphysis and is the end-point of the true conjugate When the angle is less than 90 degrees, the 'least" conjugate should be measured Whatever the angle, the Caldwell and Moloy conjugate will never be less and usually will be greater than the true measurement

About the measurement of the transverse diameter of the inlet, there is no dispute Oblique diameters are of little value and are difficult to measure with accuracy

Three diameters are usually measured in the mid pelvis the anteroposterior, the posterior sagittal, and the bi-spinous A fourth should probably be added, the anterior or true transverse, between the flat opposing surfaces of the ischia anterior to the bases of the spinous processes, called by Caldwell and Moloy the inter-tuberous There is disagreement regarding the posterior end-point of the sagittal plane diameters The really significant end-point is at the sacrococcygeal joint This is especially the case when the sacrum curves sharply forward The bi-spinous diameter is usually regarded as the significant transverse diameter of the mid-plane Studies by the author indicate, however, that the distance between the flat opposing surfaces of the bodies of the ischia is better This is clearly distinguished on the frontal film

The outlet is not composed of a single plane, but of two triangular planes resting on a common base Measurements usually made at the outlet are the subpubic angle, bi-tuberous and pubo-tuberous diameters, and the posterior sagittal of Klein There is no generally accepted technic of measuring the sub-pubic angle The most efficient method is that of Chassard and Lapiné The end-points of the bi-tuberous diameters cannot always be accurately determined This diameter should not be confused with the bi tuberous of the mid-plane of Caldwell and Moloy The obstetrical significance of the pubo-tuberous diameter has not been established The posterior sagittal of Klein cannot be measured with accuracy

Two subsidiary methods are discussed that known as charting or reconstruction (Williams and Moir) and the method of calculation of the areas of the inlet and mid-plane The charting methods are simple for the inlet but not for the other planes The calculated area method is useful in borderline contracted pelves, but may be misleading in cases where there is a marked difference in the two diameters used

In his second contribution Allen considers the morphology of the pelvis, though this is of secondary importance, obstetrically, to mensuration Standardization of classification and description is just as desirable in the identification of pelvic shape as it is in measurement Four main types are generally agreed upon by various authorities, the gynecoid, android, anthropoid, and platypelloid, though the names applied vary somewhat. Caldwell and Moloy include fourteen subtypes All authorities determine the shape of the pelvis from the shape of the brim, disregarding possible alterations in shape at lower levels While this is not scientific, it is acceptable as practical

For the purpose of standardization some mathematical expression to indicate the pelvic shape should be evolved At present most authorities depend upon the sensory impression of the observer, which is not sufficiently accurate

An attempt was made to correlate the four chief classifications of Turner, Thoms, Caldwell and Moloy, and Steele and Javert, by a mathematical expression, but the figures resulted in such confusion that a practical basis of standardization could not be evolved. Particular difficulty was met with in the android pelvis.

The best available approach to standardization at present seems to be some form of expression of an index of the pelvic brim, that is, the ratio of the anteroposterior to the transverse diameter The author suggests returning to a simpler classification round pelvis with a brim index of 85–100 per cent, long oval pelvis, with brim index over 100 per cent, and flat pelvis with a brim index less than 85 per cent

SYDNEY J HAWLEY, M D

A Preliminary Report on the Pelvic Brim Index. O S Heyns J Obst & Gynaec Brit Emp 54 39–64 February 1947

This paper coming from South Africa, reports pelvic brim index values derived from series of South African Negro or Bantu pelves and discusses the variation of the index figures in different races and under different conditions

In Part I the significance of the pelvic brim index is stated, and reference is made to the belief that under favorable healthy living conditions the index appears to be higher than in circumstances of poverty The brim index in different races is surveyed and ontogeny and phylogeny are considered under two heads (*a*) general, and (*b*) Bantu data

Part II is devoted to an analysis of anatomical observations The validity of certain current hypotheses is tested, and the factors influencing the brim index are considered under the following heads

(1) *Epiphyseal Bone Growth* The mechanism of increase in size of the pelvic girdle is considered and the increase during ontogeny of the brim axes and sacral breadth is analyzed The effect of rickets on growth processes is discussed and a statistical analysis of individual variables and their relation to the brim index is presented

(2) *Development of the Sacral Alae* This was found statistically to be negligible

(3) *Pathological Bending of the Girdle Due to Anterior-Posterior Compression* There appears to be no evidence in favor of this possibility in cases of mild rickets

(4) *Anterior Projection of the Sacral Promontory* The effect on the index of anterior projection of the sacral promontory is analyzed anatomically and an

explanation offered of its lack of significance relative to index variations

In his discussion the author concludes that there is no evidence that malnutrition of moderate degrees influences the brim index He emphasizes bone growth at the symphysial epiphyseal cartilages as an important factor in increasing the transverse axis of the brim and submits that it is to activity in this region that the human girdle owes its morphology Physiological, as opposed to pathological, bending of the pelvic girdle is considered to be present The mechanics of this factor are held to be complicated, and not susceptible of simple experimental proof SYDNEY F THOMAS, M D

THE GENITO-URINARY SYSTEM

Nephrography H Stephen Weens and Thomas J Florence Am J Roentgenol 57 338–341, March 1947

Certain substances, such as dyes and iodides, are to a smaller or larger extent directly eliminated by the tubular epithelium of the kidney Tubular function is not inhibited in acute ureteral obstruction In this condition iodine compounds may be excreted into the renal tubules where the contrast medium will remain, creating a diffuse opacification of the kidney on roentgenologic examination The authors have used a small rubber bag attached to a radiopaque ureteral catheter, which they inserted into the proximal or midureter The rubber balloon was then dilated with 0 5 c c of mercury Following this, 30 to 35 c c of 35 per cent diodrast solution was injected intravenously Thirty minutes later a satisfactory kidney shadow was obtained. One of 8 patients in whom the procedure was employed had moderate pain, 2 had marked pain No ill effects followed

Nephrography makes it possible to demonstrate the excretory portion of the kidney It should be possible to demonstrate tumors, cysts, abscesses, and infarcts as defects in the opacified kidney Congenital anomalies and ectopic kidneys can also be better studied by this means The kidney can be differentiated from extrarenal masses It can also be much more readily identified in oblique and lateral projections Nephrography may thus often be a valuable adjunct to our present methods of roentgen study of the kidney

CLARENCE E WEAVER, M D

Large Hydronephrosis of a True Supernumerary Kidney Samuel K Bacon J Urol 57 459–466 March 1947

The author states that only 43 cases of supernumerary kidney have been reported since 1677, indicating that it is probably the rarest of renal anomalies It must be differentiated from a double or fused kidney in that it is attached to a normal kidney only by a loose cellular attachment or not at all

A forty fourth case is reported in a forty seven-year-old married woman, who was first subjected to appendectomy because of right lower abdominal pain of several years duration Acute appendicitis" was diagnosed by a pathologist The patient was referred to the urologist on the eighteenth postoperative day, when she stated that the right side of her abdomen had begun to enlarge one week following the appendectomy Physical examination revealed a cystic mass occupying the right half of the abdomen and extending across the mid line The ureteral orifices were normal on cystoscopic examination, but there was complete absence of excretion of indigo carmine, injected intravenously, on the right An abdominal roentgenogram showed the mass, with displacement of the catheterized right ureter to the left Pyelography revealed an enormous hydronephrosis with a normal appearing renal shadow above After drainage of the hydronephrosis by an indwelling ureteral catheter pyelography demonstrated a moderately hydronephrotic right kidney in the usual location The diagnosis of an anomalous kidney was suspected before operation This consisted in removal of the hydronephrotic accessory organ with ligation of its ureter The relationship of the ureter of the accessory kidney to that of the normal is not stated Progressive dilatation of the ureter of the remaining right kidney resulted in reduction of hydronephrosis and clinical recovery

PAUL R NOBLE, M D

Necrosis of the Renal Papillae and Acute Pyelonephritis in Diabetes Mellitus Hugh A Edmondson, Helen Eastman Martin, and Newton Evans Arch Int Med 79 148–175, February 1947

This is a long article with a good review of the literature and observations based on 859 necropsies on diabetic patients (2 7 per cent among 32,000 consecutive autopsies at the Los Angeles County Hospital) The authors point out that the frequency of necrosis of the renal papillae is greater than they had suspected and after the recognition of the first few cases, the prevalence of the condition became more apparent This was true radiologically, clinically and pathologically

The lesion should be considered in any investigation of the following types of diabetic patients (1) Those with sepsis in whom urinary symptoms or findings suddenly develop, (2) those who go into coma rapidly with nitrogen retention, but without an antecedent history of pyelonephritis, (3) those with low grade pyelonephritis who suddenly become worse, (4) those with hematuria or renal colic, (5) those with severe diabetic acidosis whose blood sugar and carbon dioxide-combining power may return to normal after treatment, but who show an increasing degree of stupor and rising non protein nitrogen when shock and tubular damage can be excluded, (6) those with characteristic roentgenographic changes

Retrograde pyelograms are usually diagnostic, particularly if the lesions are bilateral and symmetric In only 4 of the authors' series was retrograde pyelography done

The roentgenographic findings have been described by others "(1) The earliest lesion is a deformity of the tip of the calyx such as that seen in pyelonephritis, (2) with narrowing of the neck of the calyx by separated particles a picture of peripheral excavation extending into the cortex may occur, (3) ring shadows may be seen in the necrotic papillae, (4) replacement of the concave tip of the calyx by dilation so great as to suggest cavern formation, (5) tip of whole papillae may slough off and appear as free masses in the renal pelvis " Of course, the differential diagnosis still lies between pyelonephritis without necrosis, a stone with renal colic, renal tuberculosis, [or actinomycosis] and renal tumor

This peculiar necrosis of the kidney is thought to arise because the blood supply [arcuate artery] is blocked and intravascular clotting probably takes place Some of the comments on the inflammatory lesions in these kidneys are of interest SYDNEY F THOMAS M D

A Current Study of Radiologic Investigation as Applied to the Diagnosis of Ureteral Stone and to the Study of Its Further Effect on Kidney Function R Hickel J de radiol et d'électrol 28 24–33, 1947

This article contains a rather complete discussion of ureteral stones, their frequency, type, occurrence singly or as multiple stones etc, as well as a recapitulation of the steps in searching for them The procedures outlined are those which by now are rather familiar to all, and for the most part need not be discussed in great detail the scout film, the film with catheter *in situ*, the film with the catheter withdrawn which will occasionally reveal a shadow masked by that of the overlying catheter, the noting of obstructive changes in the calices above as reason for continued investigation

Compression by means of a pneumatic bag is seen in most of the author's films One of the large circular variety is used, which prompts the remark that a blood pressure cuff will be found by many the most adaptable and efficient compression device available

The author stresses another point, the noting of what he terms "pre-papillary images," or tiny isolated calyceal fillings which are not accompanied by proper infundibular shadows, as evidence of partial obstruction

The illustrations are good, and abundant and the points emphasized are worth while, especially as a review of what one might call the 'errors and safeguards" in approaching the problem of ureteral stone from the radiologist's standpoint PERCY J DELANO, M D

THE BLOOD VESSELS

Use of Radioactive Sodium in the Study of Peripheral Vascular Disease Beverly C Smith and Edith H Quimby Ann Surg 125 360–371, March 1947

In order to obtain accurate information regarding the competency of the peripheral circulation, Smith and Quimby injected intravenously radioactive sodium in the form of sodium chloride solution, recording the time of arrival at the part, usually the sole of the foot, and following the rate of accumulation of the material in that area They found that the rate of increase of radioactive material in the intravascular fluid spaces and the final level attained depend on the adequacy of the arterial circulation, the condition of the capillaries, and the nature of the tissues This build-up to equilibrium can often be related to the degree of pathologic change in the vessels of the extremity The disintegration of the radioactive material was detected by means of the Geiger-Müller counter

A series of normal curves was plotted from investigations on 25 young healthy individuals without clinical history or laboratory evidence of peripheral vascular disease. These studies are of particular benefit in indicating the use of conservative or surgical methods, as judged by the efficiency of the collateral circulation If surgery is necessary the site for amputation at which healing is to be expected is determined

In addition, study of a group with essential hypertension indicates a possibility that this test can be used to select cases which will or will not be expected to respond to thoracolumbar sympathectomy

ELLWOOD W GODFREY M D

Idiopathic Thrombosis of the Axillary Vein. Walter R Miller and George F Woelfel U S Nav M Bull 47 508–514, May-June 1947

The authors give von Schrotter (1884) credit for the first reported case of idiopathic thrombosis of the axillary vein, sometimes known as 'strain thrombosis" In the two cases presented here, no history of trauma could be elicited Otherwise both cases showed the essential points characteristic of this entity Venograms from both are reproduced

Signs and symptoms usually precede medical attention by two to four weeks and, for the most part, subside in another two to four weeks The venous engorgement and dusky cutaneous color, however, persist for months Only two deaths have been reported out of some 50 cases recorded in the literature.

Several theories exist concerning the etiology (*a*) distention of the veins due to back pressure from increased intrathoracic pressure, resulting from the expiratory effort associated with unusual exertion of the arms, (*b*) pressure exerted by the costocoracoid ligament during abduction of the arm causing damage to the axillary vein, (*c*) damage to the subclavioaxillary venous valve by stretching of the large vein by pressure from the adjacent subclavius muscle when the arm is abducted, said to be demonstrated by plaster of paris injections in the axillary vein of the cadaver

SYDNEY F THOMAS M D

Arteriography Applied to an Anatomical Study of the Arteries in the Renal Cortex Jacques Mignot Atomes et radiations 1 72–76 February 1947

This study is an attempt to add something to our knowledge of the arteries in the renal cortex by injecting them with opaque material and photographing them As with many such studies the information falls short of that furnished by microscopic section Also because of the difficulty of getting an even distribution of the opaque material (there being vessels of such caliber in certain situations that their lumina are not adaptable to the passage of the suspension), the resulting picture might be quite misleading if the physical chemistry of the experiment were to be lost sight of The author, however, is quite frank in admitting the shortcomings of the method PERCY J DELANO, M D

RADIOTHERAPY

Radiotherapeutic Treatment of Cancer Corporis Uteri J Heyman Brit J Radiol 20 85–91, March 1947

At the Radiumhemmet a combined method of treatment of cancer of the body of the uterus has been adopted in which radiotherapy plays the primary and most important part, surgery being resorted to only in the event of failure of radiation Since 1930 there has been gradually elaborated a method of packing the uterine cavity with either tubes containing 8 mg of radium element or needles containing 10 mg of element, with wall filtration in each instance equivalent to 1 mm. of lead Additional filtration is supplied depending upon the size of the uterine cavity The method of packing is indicated chiefly by illustrations

Between 1914 and 1939 698 cases were examined and

670 treated These were classified into clinically operable, technically operable (*i e*, clinically operable cases with some complication as old age, adiposity, etc making operation inadvisable), and inoperable Only histologically proved cases are included

At the end of five years, counting the whole 698 cases, 52 per cent were alive and without evidence of disease, 52 4 per cent of those treated were alive and well Of those treated, 45 5 per cent were classed as clinically operable and 67 per cent of those were alive and well, 41 6 per cent were technically operable, with 48 per cent five year cures, and 13 0 per cent were inoperable, with 28 7 per cent five year cures

Of 316 patients treated after 1934, in which the improved method of packing was used, 64 9 per cent were alive without evidence of disease at the end of five years Twenty two of these were operated upon after failure of radiotherapy SYDNEY J HAWLEY, M D

Carcinoma of the Corpus Uteri End-Results of Treatment in 531 Cases from 1926–1940 Howard C Taylor, Jr, and Walter F Becker Surg, Gynec & Obst 84 129–139, February 1947

The authors review 531 cases of carcinoma of the corpus uteri treated at the Memorial Hospital (New York) from 1926 to 1940 The average age was 57 4 years The incidence appeared to be higher in women who had never had a full-term pregnancy The incidence of double primary tumors (cancer of the corpus and another primary cancer elsewhere) was 4 per cent Vaginal bleeding was a symptom in 96 6 per cent of cases Vaginal discharge was mentioned in 57 per cent The rate of growth and extension varied widely The average duration of symptoms was fifteen months Hyperplasia of the endometrium appeared to precede the development of carcinoma in many cases

In general, statistics appear to favor hysterectomy alone or in combination with radiation as against a program depending exclusively on radiation therapy The present program of therapy at the Memorial Hospital includes the following

(1) Radium A straight applicator extending from the external os to the top of the uterine canal is employed A dose of 3 600 mg-hr is delivered (The authors admit that better distribution is desirable) If surgery is to follow, it is done after an interval of six weeks

(2) Surgery Total abdominal hysterectomy with removal of the adnexa

(3) Roentgen Therapy 200 kv p therapy to four to six ports, each field receiving eight doses of 250 r each Roentgen therapy is now given routinely after radium in patients treated by radiation only and less regularly after hysterectomy Patients in whom surgery is contraindicated and for whom it is hoped that radiation will suffice are curetted after a four-month interval and further radium is inserted or the risk of a hysterectomy is accepted if cancer is still present

The evidence for the need of hysterectomy was shown in 119 patients who received large preoperative doses of radiation In 49 6 per cent there was microscopic evidence of viable cancer in the excised uterus The authors believe that it remains unproved that preoperative or postoperative irradiation improves the end results of total hysterectomy

The effect of the gross extent of the disease is shown by the five-year end results in five specified groups as follows Group I uterus not enlarged 66 6 per cent Group II A, uterus not larger than a two and a half months' gestation, 54 4 per cent, Group II B, uterus larger than a two and one-half months' gestation, 37 9 per cent, Group III A, extension of carcinoma to cervix, 24 3 per cent, Group III B, extension of carcinoma beyond the uterus, 11 2 per cent

The effect of histologic type was shown by the five-year end results in three classifications as follows adenocarcinoma, Grades I and II, 47 2 per cent, adenocarcinoma, Grades III and IV 22 8 per cent, adenocanthoma, 51 3 per cent

The relation of type of treatment to end-results was more difficult to evaluate In the cases in which hysterectomy was performed a five-year cure rate of 51 1 per cent was shown, while in the group of patients treated only by radiation the figure was 36 8 per cent The group with treatment limited to irradiation contained, however, more patients in a relatively advanced stage of the disease JOHN A COCKE, M D

Size of the Vaginal Vault in Relation to the Treatment of Cancer of the Cervix John Moore and Margaret Tod Brit J Radiol 20 92–93, March 1947

The possible arrangement of radium in the treatment of cancer of the cervix is influenced by the size of the vaginal vault To assist in future planning, measurements were made in 200 patients The results are presented in tabular form The largest number of patients had transverse diameters between 4 1 and 7 0 cm and anteroposterior diameters between 3 1 and 6 0 cm

The average diameter decreases with increasing age and does not depend upon the number of children SYDNEY J HAWLEY, M D

Effect of Radiation on Vaginal Cells in Cervical Carcinoma I Description of Cellular Changes II Prognostic Significance Ruth M Graham Surg, Gynec & Obst 84 153–165, 166–173, February 1947

The author reports on a series of 206 cases of cervical cancer treated by irradiation and studied by vaginal smears She first reviews the cytology of the normal vaginal secretion illustrating her discussion with excellent photomicrographs Vaginal smears from proved cases of carcinoma of the cervix are equally well described and illustrated, as well as those taken during and after radiation therapy All smears were stained by the method of Papanicolaou

The normal vaginal smear shows cells from the basal, precornified and cornified layers of the vaginal and cervical mucosa with polymorphonuclears, lymphocytes and histiocytes intermingled Malignant cells of two types are encountered in the vaginal smear in cases of epidermoid carcinoma of the cervix (1) undifferentiated, which are smaller than the normal basal cells, with hyperchromatic nuclei surrounded by a narrow indistinct rim of cytoplasm, (2) differentiated cells of bizarre shape—the so-called tadpole form and a long narrow fiber cell with elongated nucleus The malignant cells of adenocarcinoma are undifferentiated, usually occurring in tight groups with their nuclei piled on top of one another The cytoplasm is narrow and may contain small vacuoles

The irradiated cases observed were divided into four groups Group 1, in which vaginal smears were made during x ray and radium therapy, Group 2, in which smears were obtained one to six months after treatment, Group 3 in which the studies were made beginning six

months to a year after completion of treatment, Group 4, composed of patients treated one to fifteen years before the first vaginal smear was taken The effects of radiation on the normal vaginal and cervical mucosa were observed in two patients with carcinoma of the urinary bladder who received radiation similar to that given in the cases of cervical cancer

Group 1 The patients followed during treatment fall into two classes those showing definite radiation reaction in all cells and those showing little effect in any type of normal or malignant cell

The first changes in the *normal cells* are in the basal layer of the vaginal and cervical mucosa This change may be seen as early as the second day of treatment but usually is not marked until the ninth or tenth day The earliest change is in the shape of the cell It becomes elongated and the staining reaction may change from a basophilic to a brownish stain Subsequently the nuclei show degeneration by pyknosis and karyorrhexis This process starts around the tenth day of treatment and continues throughout its course Around the twelfth day of treatment, the basal cells show a marked increase in size and a related increase in size of the nucleus Vacuolization of the cytoplasm of these blown-up cells occurs about the fifteenth day of treatment Finally the basal cells assume bizarre forms—dumbbell, elongated, and tadpole shapes These cells must be distinguished from the differentiated malignant cells The distinguishing factor is the nucleus, which is large, finely granular, and hyperchromatic

The first effect of radiation noted on the precornified cells is an increase to two or three times their normal size The cytoplasmic-nuclear ratio is undisturbed This effect is noted as early as the third day and as late as the forty fifth day On an average it occurs around the fifteenth day The nucleus becomes dark, wrinkled, and fragmented The cells may become multinucleated Fibers may appear in the cytoplasm around the nucleus and large vacuoles appear, which may almost entirely fill the cell, giving it a signet-ring appearance These cells also assume bizarre shapes, similar to the basal cells The last change noted in the precornified cells is the appearance of polymorphonuclears in the cell itself This usually occurs around the twentieth day The cornified cells show a similar response to radiation except that the nucleus is already pyknotic and undergoes very little change

The *malignant cells* show radiation changes around the eleventh day, though these may be apparent as early as the eighth and as late as the seventeenth day These cells show marked enlargement, vacuolization, and multiple nuclei and may appear as giant cells The nucleus loses its granular appearance and becomes very pyknotic Half of the cases showed an increase in the number of malignant cells in the smear before they started to disappear The other half progressively showed fewer malignant cells and usually by the twenty-fourth day none at all was present

Group 2 Thirty six per cent of the cases in which vaginal smears were made one to six months after treatment showed a moderate to marked radiation reaction The effects are not lasting Two months after treatment an occasional cell showed changes At three months the specific results of irradiation have almost disappeared The changes in the basal cells last the longest Thirty-six per cent showed persistent malignant cells

Group 3 All the specific effects of radiation have disappeared in the vaginal smears obtained six months to a year after treatment Four of the 19 cases showed malignant cells due to recurrences

Group 4 The changes in cells of the vaginal smear from one to fifteen years after irradiation are not specific, but are found also after the menopause One-third of the cases showed only basal cells, which may appear normal but are found in sheets or clumps They may also be enlarged with blotchy, washed out nuclei and may show elongated forms One-third of the cases showed precornified and basal cells, which usually are normal in appearance The remaining third of the cases showed cornified, precornified, and an occasional basal cell Leukocytes and histiocytes frequently occur

It is very difficult to distinguish between the bizarre shape of an untreated differentiated malignant cell and a normal cell affected by radiation It is the policy of the author not to call post-irradiation smears positive unless typical and healthy undifferentiated malignant cells are seen

Irradiation changes in cervical cancer as seen on vaginal smears are comparable to observations on multiple biopsy specimens The notable changes are pyknosis and degeneration of the nuclei, swelling and vacuolization of the cytoplasm, evidence of abnormal mitoses, and finally leukocytic infiltration and foreign body giant-cell reaction

The author at the beginning of her second paper refers to a study of multiple biopsies performed on cervical cancer during treatment by Glücksmann and Spear (Brit J Radiol 18 313, 1945 Abst in Radiology 47 207, 1946) in order to determine, if possible, the response of the tumor to irradiation Quantitative counts were made on four types of cells (1) cells in mitosis (2) resting carcinoma cells, (3) differentiating cells, (4) degenerative cells The cells in mitosis disappeared soon after treatment was instituted The resting carcinoma cells persisted longer than the cells in mitoses, but these too gradually disappeared The differentiating cells increased, finally disappearing after treatment was ended The degenerating cells increased throughout the treatment and persisted for some time afterward A graph made by plotting the degenerating cells against the carcinoma cells in mitotic and resting stages gives an indication of the response to irradiation In a favorable case, the two lines should cross as the cancer cells decrease and the degenerating cells increase in number Unfavorable cases show the lines running a parallel course

The author has attempted to show that vaginal smears have a similar value in prognosticating the effect of irradiation by plotting the approximate per centage of malignant cells and the approximate per-centage of normal cells showing response to irradiation against the days of treatment A marked response to radiation shows a gradual decrease in the number of malignant cells and an increase in the number of normal cells showing radiation changes

The author considers a marked response of normal cells to radiation as the most important favorable sign, whether the decrease in malignant cells is rapid or slow In the small series reported, 73 cases, she considers the prognostic accuracy of the method 88 per cent A greater importance is to be attached to a poor response than a good one

By the study of the vaginal secretions during treatment, the immediate response of the tumor and normal

cells can be determined and the treatment altered in non responsive cases Radical surgery may be indicated or increased dosage of irradiation may be necessary VERN W RITTER, M D

Radiation Therapy of Uterine Myoma. Robert J Crossen and Harry S Crossen J A M A 133 593–598, March 1, 1947

A series of 526 selected cases of myoma of the uterus was treated by means of radiation therapy (with curettage to exclude cancer and conization to remove chronic cervicitis) and the results were evaluated An additional 23 cases thought favorable for treatment by radiation were excluded after primary curettage showed complicating endometrial carcinoma

The typical case for treatment by radiation was the medium sized (fist-sized) myomatous uterus in a patient of climacteric age with bleeding as the principal symptom and the pelvis otherwise clear Others the size of a grapefruit and some extending up to the umbilicus were likewise treated

In nearly all of the 526 treated cases the radiation was given in the form of intrauterine radium application, the term "radiation" meaning the usual radiation dosage for stopping myomatous activity and all bleeding, including menstrual The dosage given was from 1,200 to 2,400 mg hr , depending on the size of the tumor and other factors Of the 526 cases, 21 were interpreted as flat failures—that is, surgical intervention was later required for disturbances due to conditions presumably existent at the time of primary treatment There were also 15 cases in which the radiation stopped the myomatous activity but in which surgical intervention was later required for conditions which would have been prevented if the primary treatment had been hysterectomy and bilateral oophorectomy instead of radiation

The number of successes was calculated to be over 470, or an estimated 90 per cent of patients In this group, success was attained by the control of bleeding (principal symptom), relief of dysmenorrhea, ovulation pain and pruritus, and shrinkage of the tumor when discomfort was due to pressure. When pelvic pain was an important feature in the symptomatology, treatment by means of radiation, with some exceptions, did not give relief

The authors emphasize the advantage of radiation not only because it involves a minor risk, but also because of the fact that patients submit to treatment promptly and welcome the opportunity of being relieved of their anxiety without a major surgical operation They also caution that radiation is not necessarily the final step in treatment stating that, if the myoma continues to give trouble, hysterectomy may then be necessary

The importance of certain associated measures in conjunction with radiation therapy is stressed, namely (1) deep pelvic palpation under anesthesia, (2) curettage, (3) conization when cervicitis is present and (4) accurate recording of the examination findings in the operative note ANDREW K BUTLER, M D
(University of Michigan)

Importance of Correct Diagnosis in Superficial Radiation Therapy of Benign Skin Disease J Sommers Canad M A J 56 185–187, February 1947

This paper deals not with the actual diagnostic features of benign skin lesions, but with the importance of a correct diagnosis before radiation is administered Often the diagnosis has a direct bearing on the prognosis The technic may vary, also Thus if all types of eczema are treated in a similar manner, some patients may not obtain as much benefit from treatment as they might have received if the procedure had been altered to suit the individual type of disease In some cases, during the course of radiation therapy, the undiagnosed irritant factor may still be active and produce exacerbations which may result in placing the blame on radiation as the agent at fault, and may lead occasionally to the accusation that the patient has been burned and that the radiologist has been negligent

The author discusses various lesions, citing examples of mistakes which may result in failure of treatment. Among these conditions are contact dermatitis, sulfonamide dermatitis, eczematoid afflictions of the hands and feet, crural lesions, calluses, and corns

The object of therapy may be defeated by mistakes in diagnosis and by improper assessment of other factors, such as the degree of acuteness of a disease, its location, the presence of other pathological conditions, etc Most of the mistakes encountered by the author in practice overseas were due to inadequate history taking and to incomplete physical examination
HUGH A O'NEILL, M D

Treatment of Pelvic Tuberculosis in the Female by Radiation Therapy Based upon Experimental Evidence in the Animal and Clinical Results in the Human Ralph E Campbell Am J Obst & Gynec 53 405–417, March 1947

Bircher in 1908 introduced roentgen-ray therapy for genital tuberculosis He felt that this method of treatment is indicated primarily (*a*) in those cases with adhesive or plastic peritoneal tuberculosis in which operation offers but little help, (*b*) in those cases with cachexia in which operation is contraindicated, (*c*) in patients who refuse operation, and (*d*) in slight and benign cases Cases in which roentgen-rays are to be used secondarily include (*a*) those in which the exudate reappears soon after operation and does not disappear within fourteen days and (*b*) all cases in which the symptoms return after operation Since Bircher's original paper, some authors have felt that roentgen ray therapy should be extended to include all types of pelvic tuberculosis, while some believe that irradiation has its greatest indication as a postoperative measure following conservative or radical surgery Another group is opposed to irradiation in pelvic tuberculosis, contending that it causes dissemination of the tuberculous process, fistulous tract formation, and intestinal obstruction, while lymphocyte destruction by the roentgen rays leads to a breakdown in the healing process

The author produced pelvic tuberculosis experimentally in female dogs and subjected the animals to roentgen-ray therapy A laparotomy was usually performed about two months after the initial infection and the genital organs were inspected for gross signs of tuberculosis with confirmation of the findings by biopsy Laparotomies were performed about every two months thereafter

Roentgen ray therapy was instituted at different time intervals relative to the diagnosis and extent of the disease in order to make the investigations more complete. Twenty dogs were used in this investigation, in which the tuberculous process was limited to the pelvis Eight control dogs were inoculated with bovine tubercle bacilli and given no roentgen therapy

In analyzing the results of these experiments, it is clear that roentgen ray was beneficial in the therapy of pelvic tuberculosis Only one dog died while under treatment Radiation therapy tended to limit the disease to the pelvis and had a direct effect upon the absorption of the exudate and reduction of the secondary inflammation There is every reason to believe that in many of these dogs intestinal obstruction might have developed if x ray had not been given Some of these animals had as many as eight laparotomies and in only one instance was a fistula formed The abdominal wounds healed rapidly with only an occasional superficial infection

In comparing the control series with those treated by roentgen-ray therapy and the beneficial results obtained in the latter, the results are conclusive

The favorable results obtained in the experimental work led the author to use roentgen ray therapy in the treatment of pelvic tuberculosis in the female From his series of such treatments, he selected six representative cases which are presented in detail Excellent results were obtained

BERT H MALONE, M D

Indications for Irradiation of the Pituitary Gland in Patients with Arterial Hypertension Eugene P Pendergrass, John Q Griffith, Jr, Nicholas Padis and Robert P Barden Am J M Sc 213 192–197, February 1947

In clinical hypertension due to increased activity of the pituitary gland, it is probably the excessive secretion of the pressor hormone that is at fault While there is no satisfactory method available for the assay of the pressor hormone, a method is available for the bioassay of the antidiuretic hormone, which is usually associated with it It may be assumed, therefore, that subjects with hypertension who show increased production of antidiuretic hormone also have an excess of pressor hormone If such is not always the case, that may supply one reason why pituitary irradiation is not always effective

Slightly less than half of the patients treated by the authors by irradiation of the pituitary had a significant lowering of blood pressure, and slightly more than half showed appreciable clinical improvement There is good correlation between treatment and change in systolic and diastolic blood pressure and clinical improvement The principal finding associated with unsuccessful therapy is failure of the bioassay for antidiuretic hormone to become negative This occurs less frequently when larger doses of irradiation are given Patients with renal failure or a high titer for gonadotropic hormone in the serum are apt to do badly Complications of therapy, except for routine hair loss, did not occur in patients who did not have papilledema There was no evidence of hypopituitarism following irradiation

The chance of benefit from irradiation to the pituitary in hypertension should be at least 75 per cent under the following conditions (1) positive bioassay for antidiuretic hormone in serum, (2) a roentgen dosage of 2 X 1 000 r in air, repeated in three months if the bioassay has not become negative, (3) a negative bioassay for gonadotropic hormone in serum, (4) normal renal function as shown by plasma creatinine, (5) good clearance of injected dye from each kidney as shown by urography

BENJAMIN COPLEMAN, M D

On the Treatment of Periappendicular Abscesses, Particularly with Regard to Their X-ray Therapy T G Nyström Acta chir Scandinav 93 344–350, 1946

During a fourteen-year period, the author selected 113 of a total of 320 cases of periappendicular abscess for conservative therapy with irradiation In addition to bed-rest and the application of ice bags, the treatment consisted of one or two doses of 150–200 r (140 kv, 4 ma 30 cm target-skin distance, copper-aluminum filter) Children and adults of both sexes were included in the series

Results were encouraging inasmuch as the method apparently caused more rapid resorption of the abscess, with the formation of a more reliable protective barrier In the most favorable cases, the duration of hospitalization was shortened Neither ovarian nor skin complications were encountered in the females studied

M WENDELL DIETZ M D

EXPERIMENTAL STUDIES

Experimental Studies on the Properties of a Colloidal Suspension of Iodine in Hepatic, Splenic, Placental, and Lymphatic Radiography R Weyeneth and A Calame J de radiol et d'électrol 28 1–10, 1947

Because of the radioactivity of thorium dioxide, the authors have been searching for a new medium for hepatosplenography and other procedures which will be equally satisfactory from the standpoint of roentgen technic In their work they have utilized the rat, rabbit, and guinea-pig The particular solution employed is that of Degkwitz, a colloidal emulsion of iodine which has been used, also, by investigators at the University of Geneva The spleen and liver were visualized clearly and were more sharply outlined in films made at eighty minutes than in those made at twenty-four hours The injections (intravenous) were well tolerated, and the dye was excreted fairly promptly

Placentography by the same method was undertaken in the hope of developing a method for the better diagnosis of extra uterine pregnancy and hydatid mole and for localization of the placenta Placental visualizations were sharp but with overdosage (difficult to estimate in some cases) abortion occurred; which has for the moment prevented clinical consideration of the method Multiple infarcts in the removed placentas were noted in some cases

In work on the lymphatic system, the authors injected the solution intraperitoneally, twenty four hours later many of the lymphatic structures in the thorax were visualized, but so incompletely that it is difficult to imagine that the method may have clinical value in this field

PERCY J DELANO, M D

Observations on Radiation-Induced Lymphoid Tumors of Mice Henry S Kaplan Cancer Research 7 141–147, March 1947

A total of 198 mice, equally divided by sexes, were irradiated by groups at two weeks, one month and two,

three, four, and six months of age respectively Roentgen radiation was given in fractionated, daily doses of 50 r on twelve consecutive days for a total of 600 r of whole body irradiation, the physical factors were 125 kv p, 6 ma, 3 mm Al filter, 30 cm distance, 43 r per minute. The greatest incidence of lymphoid tumors occurred in the group irradiated at one month of age and there was a sharp drop between one and two months The number of tumors developing in the one month group was greater than the combined total among all of the older age groups There were 10 lymphomas among 38 surviving animals treated at one month of age or younger (26 4 per cent) and only 7 tumors (6 0 per cent) among 117 mice two months of age or over

Two other studies were made, employing the same roentgen dosage The mice in these experiments, however were all two to three months of age at the time of irradiation Seventy-three mice were thymectomized Of these, 35 were operated upon one week before irradiation and 38 were subjected to thymectomy about one month after the end of x-ray exposure Another group of 36 mice were splenectomized one week before irradiation, and 48 others one month after The diet and general environment paralleled the conditions in the first experiment

Of 73 thymectomized and irradiated mice 45 (22 males 23 females) survived for at least five months after irradiation Only 2 surviving mice of this group developed lymphoid tumors, one of these had been thymectomized prior to x ray treatment, the other, one month after irradiation

Fifty-seven splenectomized mice (29 males, 28 females) of an initial total of 84 survived at least five months and only one of these developed a lymphoma 231 days after treatment

The tumors were all lymphocytic lymphomas which, in most instances appear to arise in the thymus, to disseminate to the spleen, lungs liver, kidneys, and lymph nodes, and to cause leukemia in a considerable percentage of animals

Incidental observations on radiation-induced ovarian tumors and on inhibition of spontaneous mammary tumors following x ray treatment are presented

Effect of X-Rays on the Ascorbic Acid Concentration in Plasma and in Tissues Carol H Kretzschmar and Frank Ellis Brit J Radiol 20 94–99 March 1947

The beneficial effect of ascorbic acid on x ray leukopenia and radiation sickness having previously been reported, the blood level of ascorbic acid was studied in 35 patients before, during, and after treatment Lowered levels were found after treatment, but the difference was so small that it could be accounted for by random error Experiments on rabbits showed a large drop in the level after treatment Muscle from the leg and the kidneys of white rats showed depression of the ascorbic acid content after irradiation SIDNEY J HAWLEY, M D

Action of X-Rays on the Nucleoproteins of the Cellular Nucleus. M Errera Atomes et radiations 1 67–72, February 1947

This study deals primarily with anomalies of structure of chromosomes observed after irradiation of various organisms molecular phenomena are not dealt with *per se*, for the purpose of the study is to probe the relation between structural anomalies of chromosomes and the occurrence of mutations

The work is based upon irradiation of solutions of nucleoproteins The alterations in the nuclei and their dissociation tend to produce varying changes in the stability of the solutions studied, these changes are modified by roentgen intensity, temperature, time observed after irradiation, and other factors, which are taken cognizance of in charting results Some of the nuclear changes, the author believes, are basically the same as attend rupture of chromosomes, this conclusion, however, as he admits, is definitely hypothetical, and should be interpreted as speculative in the same manner as many other biologic phenomena whose investigation must be approached in similar ways

The technical minutiae of the experimental work are worth the consideration of biologists engaged in this division of research, for the experiments have obviously been carried out with meticulous care

PERCY J DELANO, M D

Experimental and Clinical Results of the Use of Artifically Radioactive Isotopes within an Area for Localized Radiotherapy J H Muller Schweiz med Wchnschr 77 236–239, Feb 15 1947

The author points out that in addition to intravenous or other parenteral routes with generalized distribution non-toxic radioactive substances may be given parenterally in a form which will lead to their local retention After suitable animal experiments he administered a macroscopic suspension of Zn^{65} in a pectin sol base intraperitoneally to three patients with advanced peritoneal carcinomatosis (primary in ovary) All of these women were considered beyond help from any of the standard forms of treatment All showed moderate to marked clinical improvement with decrease or absorption of the ascitic fluid previously present Two died later, and an autopsy examination on one showed little evidence of the effects of the treatment The third patient was discharged improved Animal experiments had showed that the mixture remained in the peritoneal cavity, and studies of the blood and urine of the patients beginning two hours after the injection showed no radioactivity to be present The author feels that this type of treatment offers considerable promise as a supplementary method LEWIS G JACOBS, M D

Effect of Gamma Radiation on Mitosis in Vitro I Simon-Reüss and F G Spear Brit J Radiol 20 63–70, February 1947

Cells from the choroid and sclerotic of chick embryos in culture were irradiated with doses from 55 to 1,320 r at the rate of 22 r per minute and the subsequent effect on mitosis was observed by photographic methods

At 55 r there was little alteration in cell behavior At 88 r about half the observed dividing cells were affected There was arrest in metaphase bubbling of the cytoplasm followed by break up of the cell, and in some divisions both nuclei went into the daughter cell At 330 r these changes were observed in the majority of the cells In addition, many cells arrested in metaphase broke up Fragmentation of the chromosomes was frequent Mitosis which started an hour after irradiation was completed in almost normal time

After 1 320 r, mitosis was very scanty, no cells completing division normally There was little recovery after one hour

The chief difficulty in studies of this type is to determine the beginning of the prophase In the present

study timing was begun at the beginning of metaphase to avoid this difficulty SYDNEY J HAWLEY, M D

A Chemical Model Investigation on the Primary Action in Biologic Radiation Effects W Minder Schweiz med Wchnschr 77 194–195, Feb 8, 1947

The author points out that the obvious biologic effects of irradiation are not basic, but the result of a chain of reactions By means of chemical experiments on the ionization of aqueous solutions of various organic and inorganic chemicals following irradiation, he reaches the conclusion that the first action is on a relatively small and simple particle This is composed of about three quarters water, the balance being carbon, hydrogen, oxygen, and nitrogen The radiation energy is absorbed by water and transferred by diffusion, possibly of an activated form of water, and the reactions of oxidation, reduction, hydrolysis, and molecular fission then take place on contact with this activated diffused substance

LEWIS G JACOBS, M D

Study of the Irradiation of Experimental Malignant Bone Tumors O Schürch and E Uehlinger Schweiz med Wchnschr 77 181–186, Feb 8, 1947

Sarcoma of the femur was induced in 7 rabbits by the intra osseous injection of mesothorium salts Four were of the spindle-cell type and 3 of the osteogenic Following the development of a tumor and biopsy, protracted fractional irradiation was given to total doses of from 450 to 2,340 r After an interval of from four to sixty one days, a microscopic study of the primary growth and of irradiated and unirradiated metastases showed no histological effect, nor was any clinical effect noted The authors ascribe these negative results to an insufficient dose of radiation

LEWIS G JACOBS, M D

Effect of the Combined Action of Benzpyrene and Luminous and Roentgen Irradiation on the Root Growth of Vicia faba vulgaris P Cottet and W Minder Schweiz med Wchnschr 77 195–197, Feb 8, 1947

Eight lots of 100 seeds of *Vicia faba vulgaris* were soaked for twenty-four hours in a glycerin water solution of benzpyrene, the seeds absorbed twice their weight of solution and could be shown to contain benzpyrene by spectroscopic study of their acetone extract The effect of this procedure alone was a 40 per cent acceleration of root growth on the fifth day The presence of light partly suppresses this response, an effect ascribed to photosensitization X-rays were given to some seeds (200 r, 190 kv, 40 cm distance), the normal observation was some slowing of root growth. This was markedly accentuated by preliminary benzpyrene treatment, probably because there is a concurrent increase in radiosensitivity with the acceleration of the vital processes by the chemical

LEWIS G JACOBS, M D

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Therapeutic Radiology

Carman Lecture[1]

DOUGLAS QUICK, M D

New York, N Y

IT IS, INDEED, MOST fitting that a great name in radiology should be kept constantly before us as an inspiration The name of Russell D Carman is, and will be, perpetuated by his work, and without the aid of our special lectureship We, however, as members of a great national society in which he was a moving spirit, need the constant stimulus embodied in the memory of men of the Carman ideals and vision, in order that we may carry forward the work to which they have made such great basic contributions It is proper, therefore, that we set aside one period of our annual meeting for reflection, for contemplation of the assistance given us by our illustrious predecessors, and for review of our position on some timely general subject or problem of our specialty

I shall not attempt a biographic eulogy of Dr Carman That has been most ably done by previous lecturers, gentlemen who were privileged to know our colleague and friend much better than I However, I would like to make one observation that I believe has not been stressed heretofore Dr Carman was probably the first radiologist to recognize, in a practical way, the need for electing a major interest in either diagnostic or therapeutic radiology, and being governed accordingly While he was interested in therapy, he realized that the problems of the diagnostic field, which was his chief interest, represented a full and complete sphere for his serious thought and activities Consequently, he divided the department, and, while retaining a nominal control for administrative purposes, established, in practice and in fact, the first division of a major department of radiology into diagnostic and therapeutic sections, with separate staffs and practical autonomy for the therapeutic unit

I should have liked to take this as a precedent for a discussion on a phase of therapeutic radiology, in commemorating a name associated almost entirely with the diagnostic field However, that precedent has already been established, in part by two earlier lecturers and, finally, by Dr Newell's (1) masterful and scholarly thesis of last year I shall essay on such scientific contribution, but, instead, would like to offer for your consideration a few thoughts, and suggestions perhaps, on therapeutic radiology, as we stand at a crossroads, looking forward to a wider and more complicated field for therapy by means of the radioactive agents and equipment for the production of radiations of proved or possible value

[1] Delivered at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass Dec 2, 1947

Within less than a half century, therapeutic radiology has come into being and has developed into one of the great forces in medicine The advances, while steady, have often been spectacular Action has been the keynote throughout It is just fifty-two years since Roentgen's discovery of the x-rays Is it not significant of the immediate interest therein, that the fiftieth anniversary of the founding of the British Roentgen Society was celebrated last spring, and the forty-eighth annual meeting of the American Roentgen Ray Society was held this past fall? In each instance, the initial discussions were related to diagnosis, but it soon became evident that energy of possible therapeutic value was being emitted from the same source as that producing the rays of diagnostic value In 1898, just three years after Roentgen's discovery, the announcement of the discovery of radium was made by Marie and Pierre Curie From the meager bit of experience already accumulated with x-rays, it was but natural that some effects on tissues, from the radium rays, might be anticipated It is probable that the well known Becquerel "burn" in 1901 hastened the trial of radium for medical purposes

In point of time, therefore, the entire development of our present great specialty of therapeutic radiology, from its initial crude and empiric beginnings to its present scope and level of scientific accuracy and application, represents a period of not more than forty-five years

During the earlier part of that period, the chief interest was centered about radium X-rays, in the beginning, were of interest for their superficial biological effects, but it was not until the higher voltages of the 1920 level became available, that serious attention turned to rays produced in this manner as a possible means of influencing neoplastic tissues at depth We are indebted to the President of this Society (2) for a very complete and practical review of early radium usage, in his 1946 Janeway Lecture before the American Radium Society He has told us that Pierre Curie was so impressed by the medical possibilities, as suggested by Becquerel's "burn," that he gave some radium for experimental purposes to Danlos of the St Louis Hospital, Paris This work was of a superficial character only, and it was not until after the *Laboratoire Biologique du Radium* was established, under the auspices of M Armet de Lisle, that H Dominici, working in that laboratory, announced the principle of filtration for radium Later, this great advance in practical usage was improved and published by Wickham and Degrais, associates, of Dominici The Radium Institute of Paris was organized and built at the instigation of Madame Marie Curie (3) in 1912 and she was made Director of its Research Laboratory, but the therapeutic service, which later came to be so well known throughout the world, was not inaugurated until 1919

Among the many historically interesting things that O'Brien has recorded from his researches into the early literature is the curious fact that the original suggestion for interstitial use of radium was made by Alexander Graham Bell, inventor of the telephone He offered the suggestion in 1903 in a letter to Dr Z T Zowers

As early as 1903, radium was used therapeutically in the United States, and during the next two or three years, several well known names in this country became associated with the work It is of interest that, while the first French radium therapy was for superficial lesions, the early American efforts were directed toward the treatment of carcinoma of the uterine cervix This field still remains the one of greatest achievement for radium therapy It is a strange coincidence that the year of the discovery of radium, 1898, is also the year in which Wertheim published his procedure for the radical surgical removal of carcinoma of the uterine cervix together with the adjacent lymph node-bearing tissues While the method was neither original with Wertheim, nor as extensive as that now being tried in a carefully selected group of cases by Dr Joe V.

Photo by Pach Bros N Y

DOUGLAS QUICK, M.D

Carman Lecturer, 1947

Meigs of this city, the Wertheim operation is the one most widely known and referred to in relation to radical surgery for this particular disease In the intervening forty-nine years, there is little doubt of the relative value to humanity of Wertheim's surgical method and the treatment with radium

It was not long after the simple, empiric, single-handed efforts with radium began to show encouraging effects that more completely organized and equipped investigations were launched Kelly and Burnam, in Baltimore, were treating cases as early as 1909 In 1910, Forssell in Stockholm established a radium service This was followed in 1915 by the establishment of a radium service, under the direction of the late H H Janeway, in the Memorial Hospital, New York, then recently reorganized for the purpose under the guidance of the Cornell Medical College During the next few years, the supply of radium to that institution and at Kelly's hospital in Baltimore, was built up through the Colorado mining activities of the late Dr James Douglas and Dr Kelly, and by the generous support given to the Memorial Hospital by Dr Douglas

The use of radium advanced rapidly at the Memorial Hospital, partly because a substantial quantity of the element, together with fair laboratory facilities, was available, but largely due to the enthusiastic group engaged, whole-heartedly, in a new and fascinating project With this group, the work with radium made steady and, I believe, sound progress Appreciation of the influences of quality, as well as quantity, made for improvements in filtration, and a recognition of the value of distance, in delivering adequate depth doses

In 1916, Failla was able to seal radium emanation—radon—in fine glass capillary tubes These were embedded, interstitially, in tumor-bearing areas through trocar needles The reactions were terrific, but there was brought about a degree of local tumor control not previously accomplished Between 1917 and 1925, the use of these very slightly filtered "seeds" or implants, in spite of the criticism levelled at them because of the severity of the reactions, advanced the efficiency of radium therapy a good deal I have long had a feeling that the method should be tried again, in the light of our interim experience, and with the use of weaker individual seeds They at least went a long way toward eliminating the fallacious surface applications then so universally employed, and in calling attention to the ultimate possibilities of interstitial irradiation

It should be pointed out that the earlier work with radium, so far as this country is concerned, was not for the purpose of furthering radium as such, or investigating it as a new element, but rather for what it might contribute toward the better handling of cancer At the beginning of this century, the general view of cancer was a gloomy one The only treatment, other than symptomatic terminal care, was surgery, and the only real surgical interest, of a progressive character, was sporadic. With the prospect of added benefit by radium, and aided by the then available x-radiation, it was the radiologist—then, the "x-ray man"—who injected new life into the fight for an improved cancer treatment The more forceful his support of the crude and empiric efforts at irradiation of cancer, the more was he frowned upon by his surgical colleagues, who were grateful for his diagnostic assistance but resentful of his possible encroachment on their surgical domain There are still far too many surgeons who regard irradiation as competitive rather than complementary to surgery When the American Society for the Control of Cancer, predecessor of the present American Cancer Society, was a young and struggling organization, it was largely through the radiologists, rather than the surgeons, that it was able to gain support in making contact with the local communities throughout the country

Therapeutic radiology has initiated and then supported the drive against the scourge of cancer from the beginning of popular organized efforts in that direction,

until now those efforts, by their magnitude and multiplicity, have created for this one of the great unsolved problems in medicine a status of peculiar notoriety The propaganda needs to be shifted from the public to the public's family physician or the internist Serious and conscientious attention to well done, periodic, health examinations would advance and improve the safeguards of the public health against many conditions, including cancer

Those deeply and seriously interested in cancer as one of our greatest problems in medicine today, should ever be mindful of the fact that therapeutic radiology, in its kindergarten days, provided the spark to set off a new era in investigation and treatment of neoplastic diseases

In making a brief review of the developments in the earlier years of curie therapy, for the purposes of sequence, I should like to record one bit of very crudely done work, the results of which were not published It is of interest only because of its somewhat relationship to our present use of the products of nuclear energy Dr Janeway carried constantly in mind the hope that some means would be found whereby radium might be used as a constitutional agent We were using an active deposit of radium emanation on lead foil for various unfiltered contact surface applications of short duration Failla suggested that the active deposit be deposited on sodium chloride, ordinary table salt, then dissolved in sterile water, and injected intravenously During 1917 and 1918, we did a modest amount of this Dr Failla directed the preparation of the active deposit on salt and, under Dr Janeway's direction, I administered it intravenously in cases of Hodgkin's disease, lymphosarcoma, and the leukemias It had a profound effect on the blood picture of the patient, as well as on the hands of the operator It seemingly conferred some benefit in leukemia For various and obvious reasons, however, it was discontinued and would have been entirely forgotten, were it not for the present interest in the intravenous use of the radioactive isotopes

I have referred to the interstitial use of glass radon seeds For several years after their introduction, they were severely criticized because of the intensity of the local reactions following their implantation The only justification we had for continuing their use was the plain fact that they accomplished results that we were not otherwise able to duplicate After many trials, using various metals and methods of sealing, Failla was able, late in 1924, to collect radium emanation in a fine gold capillary tube, divide it into short sections, and seal the ends so as to prevent leakage of radon Thus the filtered radon seed was an accomplished fact After some months of further experiment with the gold seeds, Failla turned a supply over to me for clinical use Treatment of patients by this method actually began in June 1925 There has always been a great deal of controversy over the relative value of the gold radon seed *vs* the more heavily filtered radium element needle, for interstitial irradiation The greatest opposition was from the proponents of the French school This is not the place to review the arguments, pro and con There is, obviously, a place for each method .

Interstitial irradiation, first, and intracavitary irradiation, second, represent the most efficient general methods of radium usage These technical adaptations of radium application provide the most efficient means, to date, of irradiating small, inaccessible, or otherwise technically complicated, tumor-bearing areas The range of application, especially as a source of supplemental irradiation, is indeed great It requires patience on the part of the operator and a peculiar painstaking experience which embodies some risk, in order to avail oneself of these advantages, but it is worth it Since Failla's development of the gold seed implant in 1925, radium therapy has made substantial progress Methods have become standardized and stabilized The range of application has been reduced, for reasons to be mentioned shortly, but the work is on a much more rational and substantial basis The gold-

filtered radon seed, however, was the last great spectacular development in the rapid rise of curie therapy

X-ray therapy had been struggling along on a largely empiric and, technically, superficial-therapy basis, while radium was occupying the center of the stage The real force, and that directed almost entirely against cancer, was radium, x-rays were of interest, but weak

The difficulty with x-rays of the earlier period, for therapy, was largely a matter of equipment The generators employed to activate the tubes were not powerful, but they were, at least, relatively as powerful as the tubes About 1912, there were some fundamental researches in pure physics on the quality, as well as quantity, of x-rays, filtration and its relative value were better understood With improvement in tubes, especially the advent of the Coolidge hot-cathode tube in 1913, the equipment to activate them improved Research and the development of equipment for producing x-rays moved ahead apace, until the so-called high-voltage units, operating at or near to 200 kv , became available soon after 1920 For the first time, a reasonable quantity of x-rays could actually be delivered to a reasonable depth For the first time, x-rays had something to offer by way of aiding in the control of deep-seated cancer For the first time, the roentgenologist had within his department, and free from outside interference, an equipment of substantial power for therapeutic purposes The psychological influence of this last fact has contributed a great deal, along with other factors involved, to create a widening gap, during the intervening years, between roentgen therapy and curie therapy

Since the early 1920's, the progress in x-ray therapy has been equally as spectacular as was the development of radium therapy in the decade preceding With the range of application so much wider and facilities for its use so generalized, it comes today to overshadow all therapy by irradiation, at least in its practical and proved applicability The x-ray therapist has been guided through these years by that small group of physicists who early elected an especial interest in radiation, and whose foresight in grasping and even anticipating the needs of the clinician have made them seem, at times, to be almost intuitive In a most able and far-seeing discussion on Training in Radiation Physics for Residents in Radiology, before the last annual conference of Teachers of Clinical Radiology, Portmann (4) paid tribute to the radiation physicists as being, undoubtedly, the best teachers of residents, in contradistinction to the majority of physicists teaching physics in institutions of higher education, who fail to grasp the practical application of their science in its relation to clinical medicine

Along with scientific and applied research in radiation physics, clinical experience has steadily advanced and, with it all, the manufacturers have not only kept pace with demands, in most instances, but, I fear, at present have perhaps run on ahead of us It must be said to their credit that, throughout these years of furious development of bigger and better x-ray therapy equipment, they have listened more to the physicist than to the clinician, at least they have usually awaited a nod from the radiation physicist before going ahead on a new venture

The international co-operation in the exchange of methods, ideas, and results has been very free and has been encouraged and facilitated by the periodic meetings of the International Congress of Radiology

Since its inauguration in 1934, the American Board of Radiology has been a powerful influence for the betterment of all radiology This is probably more completely true of the diagnostic than the therapeutic side However, much has been accomplished and much more can and must be accomplished in therapy

While the dislocations of the war years tended to retard the tempo of progress in therapeutic radiology, it did hasten one phase We were not unfamiliar with the possible therapeutic application of some of the products of nuclear energy

We had had some very slight experience, but production of radioactive isotopes was not only difficult and expensive, but was very limited as well This situation has been altered, somewhat, by the results of the development during the war years under Project Manhattan The tragically spectacular atomic bomb has tended to popularize somewhat this phase of radioactivity in the public mind and in as far as its medical application may be possible

From even this sketchy résumé, it must be apparent that a great deal has come about during the forty-five-year over-all lifetime of therapeutic radiology, of which the really active period of the specialty is little more than thirty years

It may be well, at this time, when we are confronted by problems within and when our responsibilities from without are being added to by higher powered equipment and new sources of radioactive energy, to attempt a bit of a survey of our position By a survey, in this instance, I have in mind our long-range plans for development I am concerned, as we all are, with many of our unanswered or only partially answered clinical, physical, and biophysical research problems of the moment We are all anxious about the final answers on such questions as quality of radiation *vs* quantity, selective action, periodicity, rate and frequency of delivery, together with optimum time of over-all irradiation

We are concerned with the greater accuracy incident to computation of all dosage on an intra-tumoral basis, and on a perfect integration of the gamma roentgen with the roentgen About these and many other matters, I think we need not worry too much The bright young minds coming yearly into the field, by way of the Board of Radiology and the Committee for the Certification of Radiation Physicists, will solve these problems for us, and pose new ones My concern for therapeutic radiology at this stage is in its plans for the future and in their implementation

The first impression I gain is that this specialty has rather outgrown its originally envisioned bounds—if, indeed, there were any In that semi-adolescent state, it is faced with grave responsibilities, and yet hampered by restrictions and a lack of full support to meet the obligations It very much needs today a strong, far-seeing guidance and support in order that it may develop in orderly fashion and meet successfully, not only the problems of its present scope, but those new ones already on the horizon and emanating from our new agents and equipment for the production of radioactivity of possible medical therapeutic value

When we aim at an ideal, we must admit that many compromises will be necessary in order to make it practically operable It is with a full realization of this, that I suggest a division of Radiology into a Department of Diagnostic Radiology and a Department of Therapeutic Radiology The common bond of union, a transformer and an x-ray tube, has so changed in complexion, in the two spheres of activity over the years, as to be no longer recognizable

I anticipate the first objection, namely, that few communities or institutions can support such an arrangement I believe that most Class A general hospitals of reasonable size, can, if they live up to their moral obligations and give the most enlightened services to their clients Beyond that, the smaller and more remote hospitals and communities will be able to have such advantages within less than a professional generation, as need for additional irradiation increases and as soon as trained personnel is available In the meantime, the situation in these latter areas will continue to be handled by those gentlemen to whom Portmann aptly referred in the address which I have previously mentioned, as "general practitioners of radiology" They are the men covering institutions in communities where there is not, at present, enough work, even if trained men were available, to make the division They should not be the men in larger communities, especially with more than one institution, who insist,

for competitive or other selfish reasons, on maintaining two or more second-rate therapy departments when the area could well support one department which would be both a credit and a benefit to the district

I appreciate fully that many, probably most of the senior men, and especially those in charge of large departments, will take keen exception to my suggestion of a split in the Department of Radiology I suspect that sentiment, more than anything else, will be the impelling force back of that objection Some of these gentlemen have a very sincere interest in therapy, even if it is a secondary one I am sympathetic with their feeling, but I am confident that they are fair-minded enough to favor the best interests of those in need of irradiation therapy I hasten to explain that this is no implied criticism of what has been done thus far, or of those stalwart gentlemen who have contributed most to the development of so much radiology in so few years Most of the contributions in both branches have been made by men who were, in reality, "general practitioners of radiology" By their very contributions, they have of necessity added to the complexity, as well as efficiency, of radiology, until we are now in need of some "special practitioners of radiology"

Diagnostic radiology, in all of its branches, is today almost more than a full-time study in itself When therapy is added, it becomes of necessity a secondary consideration and, as such, is all too often passed over hurriedly Therapeutic radiology is much too serious a problem, and the stakes are too great, to be passed over hurriedly There are too many errors of omission, and casualties, these days, from hurried treatments and from the employment of treatment factors which facilitate the more rapid movement of patients through the department or office Such procedures have their economic advantages but the economy is not on the side of human life

As presently constituted, the average Department of Radiology thinks largely in terms of diagnosis, and but slightly of therapy That was exemplified very nicely at the Annual Conference of Teachers of Clinical Radiology in Chicago last February The morning session dealt largely with the teaching problems incident to diagnosis, and but little with those of therapy In the afternoon, a discussion of training in pathology for residents made no distinction between the basic needs in diagnosis and therapy and gave no indication that the diagnostic man might profit more by a full dose of general surgical pathology, while the man inclined toward, or "majoring" in, therapy would spend his extra time more advantageously in tumor pathology

A review of calendars of graduate training courses shows much more attention to diagnosis than to therapy A reasonable variation on this score is to be expected, but the disparity is too great to be healthy for therapy Furthermore, the time allotted to radium grows less and less There are logical, even if unfortunate, reasons for this The development of x-rays during the past twenty or more years has tended to create an improved and efficient Department of Roentgenology rather than of Radiology The development of efficient and flexible equipment x-ray therapy has tended to "over-exten therapeutic roentgenology, often unco sciously, in an effort to keep thera strictly within the department It always under the complete control of t roentgenologist, and besides, it is safer f the operator and does not get lost

Radium should bear its fair share blame for its present miscellaneous pos tion In the early days, the ownership control of radium, or both, varied betwee institutions, special departments of in stitutions—not necessarily the x-ray de partment—and individuals Precedents often unfortunate ones, became established and such prerogatives are often difficul to alter The same method of trial and error, usually the latter, may obtain today as it did in the beginning One of the greatest handicaps incident to this irregular

arrangement of radium control has been the pernicious habit of subleasing by the owner, whether the owner be institution or individual I am convinced that this has been productive of more harm and damage, in the past, than all of the discrepancies of judgment that have been charged up against the reliable commercial radium companies in their leasing operations

It is not within my province, nor indeed would I be capable of suggesting the various ways and means necessary, in so many and varied circumstances, to bring radium back under the wing of the Department of Radiology or, better still, the Department of Therapeutic Radiology, as completely as is x-radiation It may, in some instances, require pressure, in others, time Ultimately, however, it is essential The therapeutic radiologist must be that, and not a therapeutic roentgenologist If he chooses, in his adjustment of activities, to be the latter, he should at least be capable, by both training and experience, of determining and directing any necessary radium usage To that end, an adequate supply of radium in suitable form must be an integral part of the equipment in the department Unless the director of the department is capable of meeting his obligations on the curie therapy side, the department is not suitable for training residents in therapeutic radiology Such men are very much needed now, and the demand is increasing It will take time and ingenuity to bring about the re-adjustment of many departments, but it will be well worth the effort A little of benevolent indulgence toward the occasional antagonistic head of a special service department will, ultimately, react to the advantage of both that individual and the therapy department The occasional indifferent therapy department may need a bit of pressure Radium fills a place in the field of radiation therapy that, so far, cannot be otherwise provided, unless it is used, and its application taught, the man in training will never know of those advantages, and the unfortunate patient is apt to become a casualty by omission Economically, it is quite feasible to have an adequate supply of radium for all qualified therapy departments or individuals The cost has decreased in the ratio of about 5 1 in the past thirty years Adequate supplies are available today by either purchase or lease of the element, or purchase of radon Details of organization must vary considerably in institutions, and depending on personalities, interest of available specialists, and association or not with a tumor clinic Co-operative effort will solve these problems The important feature is to have the radium a part of, and controlled by, the therapy department It should not be loosely and miscellaneously spread about

I have no sympathy with the idea of government control of medicine However, it is interesting to note that the requirements of the National Radium Commission and the Medical Research Council of England, for usage of radon supplied from centers under their control, are much more rigid than we adhere to in this country They sound very reasonable The application is limited strictly to trained and qualified physicians It is to be hoped that the regulations do not run afoul of too many politicians

It may be a bit surprising to some that I have favored a compact and complete department for radiation therapy, rather than therapy controlled by a cancer expert There are two reasons for that decision Besides, I might counter with the suggestion of special training in cancer surgery for the therapeutic radiologist, were it not that his prospective responsibilities for some time ahead are already more than full Even at that, it is imperative that he have at least a substantial clinical knowledge of cancer and of tumor pathology

There was a time when I would have favored placing therapeutic radiology under the clinical cancer specialist, even splitting the therapy, perhaps, between the special departments of cancer management Time and experience rather sug-

gest that the cancer therapist or cancer specialist is too changeable to be vested with any such responsibility Cancer institutes and special cancer hospitals are very necessary in our present medical and institutional framework They have been known, however, to follow trends Their trends, for a time at least, carry weight The advantages of modern surgery make one more trial of ultra-radical surgery look very tempting to the young cancer clinician with a surgical training An institution dominated by his zeal would, ultimately, contribute an ample material to therapeutic radiology, but would it contribute to improving the efficiency and administration of that therapy? It would probably be safer to increase the radiological requirements in that young man's training and then have him examined for certification as a cancer clinician by a therapeutic radiologist

In special cancer hospitals with a large clientele, and in general hospitals, particularly teaching institutions, with large radiation therapy departments, would it not be advantageous to have two therapy services instead of the traditional single service? The principle of friendly competition might be a worth-while stimulus It has been so, in the past, in the organization of medical and surgical departments

The other reason for establishing, maintaining, and developing a major department of therapy by irradiation on its own recognizance, and free from shackles of influence, is the fact that this specialty, today, covers a good deal more than the irradiation therapy of neoplastic diseases More attention is constantly being given to some of the infectious, inflammatory, and functional diseases The super-voltages of the cyclotron, betatron, and synchrotron will alone require the guidance of a super-therapist The same applies to the possible medical uses of the many and increasing products of nuclear energy If materials of such potentialities are allowed free range among those who would gladly toy with them, the unhappy results might very well eclipse some of the earlier experiences with X-rays and radium The potential personal dangers, even to experienced operators, with the powerful radiations being used and contemplated at this time, make an ever increasing rigidity of control imperative That control should be placed and remain where a painful experience at the lower levels of radiation potential has already been accumulated

Time and experience will determine the various off-side contacts and relationships of such a broad basic general department of therapeutic radiology It may very well be advisable to make different co-operative arrangements with different specialty departments, depending upon their peculiar needs For example, the character of the irradiation employed in dermatology differs so completely from that employed elsewhere, that the question of autonomy, or rather continued autonomy, arises If such is to be extended, would it not be advisable to restrict malignant lesions of the skin to the department of therapeutic radiology, at least in the absence of a special tumor clinic? The relationship between the therapy department and the tumor clinic will be worked out over a period of time, friendly co operation will solve the differences With the proper co-operation established between the therapy department and the various special services using some radiation for a definite part of their work, it is conceivable that a few years hence might see the therapy section of the American Board of Radiology aiding in the irradiation therapy certification as a speci service to other Boards whose diplomate have some active contact with radiatio in their one particular branch of practice At present, it is doubtful if the examinations in their phase of therapeutic radiology mean much

Regional or community planning has had a good deal of popular support and will probably be a factor of increasing importance in the development, alteration, or replacement of existing hospitals in the larger cities The New York City Planning Commission made public a compre

hensive "master plan," which included a hospitals plan, earlier this year Other cities are doing the same The American College of Surgeons has very complete plans, and stipulations of minimum standards, for various types of cancer clinics Through such studied planning, does it not seem that a more orderly development of departments of therapeutic radiology may be anticipated and a more efficient integration with special service departments and tumor clinics looked forward to?

Equipment and facilities for this type of work are unfortunately expensive and are becoming more so It is rather obvious, therefore, that all institutions cannot hope to have the same degree of perfection in the organization of the department of radiation therapy The central units in a master plan, and those strategically located otherwise, should of necessity be the complete or ultra-equipped units From that level, degrees of completeness in equipment may perhaps have to be graded down the scale to the smaller institutions and those more remotely located It will necessitate some shifting of patients among those in need of very specialized care On the other hand, all routine treatment of ordinary type and grade should be amenable to care in the nearby institution

In private practice, the same gradation in facilities and integration of the work might reasonably be anticipated and governed, for the most part, by the capabilities of the practitioner As the trend goes in our institutional development, so is it likely to proceed in outside private practice

In suggesting recognition of a division in radiology, and thus giving formal blessing to an autonomous department of therapeutic radiology, it must be realized that there is nothing about it to be legislated If the time is ripe for recognizing a division or separation of responsibilities, the new department must be so dignified as to attract some, at least, of the best minds going into radiology or some of the best minds going into clinical cancer Such individuals are not going to be satisfied or happy with anything less than the freedom of a major autonomous department It is one of those changes that must come about largely through the influence and action of the professional conscience of the radiologist There are, perhaps, a few things that might be done to encourage or activate that conscience

The first step might, quite properly, come from the American Board of Radiology It is the institution charged with the setting of standards and certifying to the fitness of candidates as judged by those standards It has long been recognized within that Board that proficiency in roentgen therapy does not qualify a man for unrestricted endorsement in radiation therapy However, it is very apt to be so misinterpreted by the candidate once he has been certified and, unfortunately, by a large section of the profession and the lay public as well The Board has been hesitant about taking a stronger position because of the limited facilities for training in radium therapy Nothing short of the insistence of the Board will change this indifference to the establishment of adequate training in curie therapy by the departments charged with or assuming responsibility for training residents in therapeutic radiology The law of supply and demand may very well be reversed and interpreted as demand and supply Several years ago, the Board eliminated radium therapy, alone, as an adequate or acceptable basis for certification In 1943, Dr George Holmes (5) suggested a revision or simplification of the groupings for certification which, in effect, would eliminate roentgen therapy alone as an adequate basis for a therapy approval He suggested three classes only as acceptable for Board certification, *viz* radiology, diagnostic radiology, and therapeutic radiology (which includes both x-ray and radium therapy) It is to be hoped that this suggestion from the conservative dean of American radiology will soon be accepted The major responsibility of therapy by irradiation is still

directed toward the relief of cancer It is a serious responsibility The least we can do is to provide and insist upon a full and complete training before endorsing the assumption of such an obligation

The American College of Radiology has done a very great deal during the past few years to improve the position of radiology in the general field of medicine The welfare of radiologists, both individually and collectively, has been its constant responsibility When radiology is willing to make another advance by accepting therapy as a major specialty, there is no doubt but that the experience and good offices of the College will be of invaluable assistance in setting up and guiding the additional organization and integration that will be found necessary

Question will at once be raised as to how additional trained personnel in therapy is to be supplied That is a problem for those who assume the responsibility for training in therapeutic radiology, and within the limitations of their teaching facilities By way of reassurance, it should be pointed out that the program is of necessity a gradual development no overnight shift is being suggested It does not mean an entirely new and additional group of post-graduate students or residents Some would simply be electing therapy entirely and, thereby, relieving the pressure on otherwise diagnostic or general radiology students As more men are trained and certified, it means that they contribute toward more facilities for the training of additional numbers of candidates Since the demand for training exceeds the facilities, care should be exerted in selecting the candidates so that the scarce and valuable training facilities will not be wasted

With all of that, however, the demand for training will, for some time, be greater than the available facilities can provide Every effort, by combinations and otherwise, should be made to afford the maximum of facilities, at least until the backlog has been met As Dr Holmes (6) pointed out in his Carman Lecture on "The Development of Post-Graduate Training in Radiology," there are many hospitals in which some branches of therapy (as well as diagnosis) may be obtained but in which all phases of therapeutic radiology are not covered It may even be advantageous for the trainee to spend the required "pre-Board" years in two or more institutions rather than in one place only The Professor of Radiology at Harvard, Dr Merrill Sosman, is blazing the trail in this direction, and by election rather than of necessity, by having his residents spend part of their time in two or more additional institutions While this plan is for the general training in radiology, I believe the doctor visualizes an extension of the same principle to augment the special training in therapy

The preceptor, as an acceptable part of the training program, is not in favor That, in a measure, is readily understandable However, is not the pathologist or the physicist a "preceptor"? Why not then the clinical radiation therapist? It ought to be possible to select an acceptable group from those not engaged in institutional departments and thereby augment the training staff

Another intriguing possibility for enhancing the training program, at least in a semididactic manner, is suggested by the proposal of a Registry of Radiological Pathology in the Army Institute of Pathology at Washington While the original plan was for diagnostic radiological pathology, there is no reason why therapy material could not also be assembled From that material, in turn, departments throughout the country could borrow, to supplement the weak points of their own facilities This might be of especial interest to those therapy departments that are weak in radium therapy and that find the development of that phase of their work temporarily hampered It is not suggested as a replacement, but it might be a help

With the ideal of better and more complete service ever before us, and supported by the demands of the constituted authorities in our field, progress in the training

and practice of therapeutic radiology will be accomplished

The progress to which we ordinarily strive and refer is that which is based on greater scientific accuracy and application It is, as a habit, a part of our times In applying the advantages of our scientific attainments, we must not forget to do so as physicians and not merely as technicians The art of medicine occupies quite as significant a place as does the science in the care of the sick, especially those suffering from the more serious diseases There is too much tendency on the part of those in some of our large teaching institutions to brush off that phase which we refer to as the art of medicine, as being within the sphere of private practice only They forget that most of their science is based on an original premise and that often, only through interim breeding, does it become a "fact" They fail to recognize that the dependent or indigent on the ward is just as much benefited by the kindly and understanding application of the high-powered treatment as is the private patient in the upholstered office It is possible that even scientific accuracy can be over-estimated In his autobiography, Hans Zinsser (7) tells us that he was once so reminded by a Scandinavian fishing-boat captain In last year's Carman Lecture on "Quality of Radiation in Roentgen Therapy," Dr Newell (1) was not too much impressed by the relative values of varying qualities of radiation, and concluded with the following comment "But I still don't see very clearly how one quality is going to be better able than another to ferret out the cancer cell" Upon the occasion of his elevation to the Presidency of the British Roentgen Society, for its fiftieth year, D W Smithers (8) delivered an erudite and semiphilosophic address on "The Radiotherapist and the Cancer Patient" Among other things in similar vein, he said, "How do we judge ourselves? By classification, standardization, and the calculation of survival rates? Or, by the comfort of mind, relief of bodily distress, and continuation of useful and pleasant existence that we help each patient to achieve"

In his Janeway Lecture, Dr O'Brien (2) has told us that "the technique of the Institut du Radium de Paris was not given in terms of dosimetry, according to Regaud, but in terms of accurate observation of the biologic effects (experience) and with emphasis on the complex physical, geometric and radiophysiologic factors, because the dose in radiotherapy is not the simple and almost independent factor which it is believed to be by common error" (Experience, rather than slide-rule)

Another danger of too much dependence on scientifically accurate treatment alone lies in the failure to recognize the advantages to be derived from progress in other fields of medicine The effects of radioactivity in tissues may be tremendously enhanced by the aid of the antibiotic drugs, under certain circumstances In the course of interviewing rather intimately, each year, a hundred or more young radiologists recently trained in our best institutions, I never cease to be shocked by the number of them who have no realization of the value of the anti-anemic group of drugs, the essential vitamins, and some hormones, as aids in meeting the problem in which they are otherwise completely absorbed In this direction alone, there is opportunity for a great deal of original investigation and advancement The therapeutic radiologist needs to be a very able general practitioner of medicine, as well as a special practitioner of his branch of radiology There is so much to be accomplished in so many directions

Perhaps, for some of us, an excellent philosophy is embodied in another reference to that grand gentleman and beloved Harvard professor, the late Hans Zinsser (7), who said, "Our task, as we grow older in a rapidly advancing science, is to retain the capacity of joy in discoveries which correct older ideas and theories, and to learn from our pupils as we teach them That is the only sound prophylaxis against the dodo-diseases of middle age"

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SUMARIO

La Radiología Terapéutica

En menos de medio siglo, la radiología terapéutica ha cobrado vida, convirtiéndose en una de las fuerzas más grandes de la medicina. Durante la primera parte de dicho período concentróse la atención en el radio, pero desde poco después de 1920, el adelanto en roentgenoterapia ha sido tan teatral como lo fuera el de la curieterapia en el decenio anterior.

Dadas las graves obligaciones que incumben hoy día a la especialidad radiológica, conviene dividirla en dos Departamentos: uno de Radiología Diagnóstica y otro de Radiología Terapéutica. En el último se hará un hincapié más adecuado en la curieterapia que el que recibe ahora generalmente. El radiólogo terapéutico o radioterapeuta no debe ser un mero roentgenólogo, sino que, por su preparación y experiencia, debe ser por lo menos capaz de determinar y dirigir todo uso necesario de radio, para lo cual un abasto adecuado de este elemento formará parte integrante de la instalación del Departamento de Radiología Terapéutica, bajo cuyo control se hallará.

Discútense aquí los problemas comprendidos en el adelanto mencionado, en particular en cuanto a organización hospitalaria, certificación (diploma) por la Junta Americana de Radiología y plan de adiestramiento. Señálase, por fin, que al aplicar los resultados de los progresos científicos, el radioterapeuta no debe olvidar que lo hace como médico y no meramente como técnico. Para ello, debe apreciar la importancia que reviste la aplicación humanitaria y comprensiva del tratamiento que está preparado para administrar, a la vez que reconoce las ventajas derivadas de los adelantos logrados en otras ramas de la medicina. El radiólogo terapéutico tiene que ser un profesante muy capaz de la medicina así como un técnico especializado en su rama radiológica.

Roentgen Treatment of Multiple Myeloma[1]

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MYELOMA IS essentially a malignant tumor of the bone marrow, which may present itself in single or multiple foci and tends to involve notably the ribs, spine, skull, and pelvis The individual tumors develop from the primitive cells of the hemopoietic system and have been accorded a variety of names, as erythroblastoma, plasmocytoma, myelocytoma, and lymphocytoma In the later stages of the disease, myelomatous deposits may appear in the liver, spleen, and lymph nodes—rarely in the lungs and other viscera (12)

It was our clinical impression that these lesions were not particularly radiosensitive Therefore, it was with some interest and surprise that we recently noted statements from two authorities to the effect that myeloma was regarded as a *very radiosensitive* lesion Shields Warren (30) observed in February 1947 that "multiple myeloma is a radiosensitive tumor—to be classified with lymphoma and Ewing's tumor of bone!" In the same year del Regato (1) wrote "Myelomas are very radiosensitive and locally radiocurable" In view of these observations, we decided to re-examine the recent literature and to review the cases of multiple myeloma which we had been privileged to see in the radiation therapy department at the San Francisco Hospital during the last two decades

INCIDENCE

Multiple myeloma is a rare disease Batts (3) reported 40 cases in a survey of almost 300,000 admissions to the University of Michigan Hospital Bayrd and Heck (4) reported 83 proved cases out of a total of 350 with a clinical diagnosis of multiple myeloma, obtained from *all* patients admitted to the Mayo Clinic up to the year 1946 Ehrlich (10), in a ten-year period at the New York Cancer Institute, saw 7 cases among some 127 primary bone tumors, only 3 of these were verified microscopically

The sexes are involved in a ratio of approximately 1 5 males to 1 female The incidence is highest between the ages of forty and seventy years, but the disease has been reported in persons as young as sixteen months and as old as seventy-eight years

Author	*Average Age*
Geschickter and Copeland	
Collected cases	55 (most cases 40–70)
Batts	
40 cases	53 (most cases 28–73)
Bayrd and Heck	
83 cases	57 (most cases 37–78)

PATHOLOGY

Myelomatous tumors are usually gelatinous in appearance and from red to gray in color Codman (8) in 1925 subdivided them into lymphocytic, myelocytic, erythroblastic, and plasma-cell types Longcope (18) in 1927 added a fifth, the myeloblastic The plasmocytomas are the most frequent and the erythroblastomas probably the least so Wintrobe (31) has pointed out that the plasma cells of the myelomas differ in certain respects from ordinary plasma cells The chromatin of the nuclei of the cells of the plasmocytic myelomas does not show the characteristic "spoke-wheel" arrangement, and the perinuclear clear areas seen in true plasma cells are hardly ever observed The tumor cells have no osteoclastic or osteoblastic properties They form small nodules which

[1] Presented at the Thirty third Annual Meeting of the Radiological Society of North America, Boston, Mass, Dec. 1–5 1947

[2] Associate Clinical Professor of Medicine (Radiology) and Teaching Assistant in Radiology, respectively, Stanford University Medical School San Francisco From the Division of Radiology, Stanford University Service San Francisco Hospital, and the Department of Public Health, San Francisco

grow by expansion and tend to necrosis and hemorrhage The abnormal plasma cells almost always are found in the sternal marrow even in patients with apparently solitary myeloma (Bichel and Kirketerp, quoted by Snapper, 26) Lichtenstein and Jaffe (17) believe that cellular subclassification of myelomas is not warranted, and that the disease is essentially of unitary cellular type, the cytologic variations reflecting stages in the maturation of the basic tumor cell

Metastases are found in the lymph nodes, spleen, liver, and other viscera, though very rarely in the lungs Involvement of the kidneys, adrenals, and almost every other organ has been occasionally noted (17) Amyloid deposits are not infrequent

Relationship to Solitary Myelomas Schinz and Uehlinger (25) believe that multiple myeloma is primarily a solitary tumor, which, however, is usually seen in the multiple stage on account of its tendency to metastasize to other bones Toth and Wintermantel (29) stated in 1943 that 48 cases of so-called solitary myeloma had been reported and only one-fourth of these remained solitary after four years There are two main types of solitary lesion, the osteolytic type and the giant-cell type The lesions of the osteolytic type are sharply demarcated and show little if any expansion They are usually found in a single vertebra or shaft of a long bone, and must be differentiated from *metastatic carcinoma* and other bone-destructive conditions Lesions of the giant-cell type are multilocular and osteolytic, with sharp demarcation and occasional expansion, they must be differentiated from *giant-cell tumors* and *fibrocystic disease of bone*

CLINICAL ASPECTS

The onset of the disease is usually insidious, with a period of malaise and gradually failing health as the earliest manifestation

Pain The first dominant symptom is pain, usually of a vague, wandering or "rheumatic" type, often in the lower back and pelvis The type, location, and duration of the pain are not characteristic At times it is sudden in onset, especially when associated with a pathological fracture Geschickter and Copeland (11) describe a pain cycle consisting in moderately severe pain at first, followed by a remission, and later by recurrence, approaching maximum severity in the terminal stages of the disease

Tumor Formation Palpable tumors, usually on the skull and trunk, were found in 50 per cent of Batts' cases (3), but in only 12 per cent of Bayrd and Heck's (4), both series being made up of multiple myelomas Tumor formation may be the initial symptom that calls attention to the disease

Pathological Fracture Pathological fracture occurs frequently and is often the presenting complaint Geschickter and Copeland noted that among bone tumors, pathological fracture is most commonly encountered in multiple myeloma, then in decreasing order in bone cysts, metastatic carcinoma, giant-cell tumor, and finally sarcoma In multiple myeloma, the majority of the fractures occur in the spine and ribs, in contradistinction to pathological fractures in the long bones in other types of bone tumor, perhaps because the myelomatous deposits are more frequent in the flat bones

Neurologic Manifestations Compression fractures of the spine may produce a sudden or gradual paraplegia Radicular pain is among the most common signs of multiple myeloma Scheinker (24) believes that the frequent pains of patients with myeloma may be partly due to a "polyneuritis caused by the absorption of toxic substances from the myelomatous tissue" He designated this polyneuritis as sclerosing interstitial perineuritis Geschickter and Copeland (11) found neurologic involvement in about 40 per cent of cases, and Bayrd and Heck (4) in about 14 per cent

Miscellaneous Features Weight loss, anemia, abnormal bleeding, or renal symptoms may be the presenting complaint

The disease may progress slowly or rapidly, long remissions may occur, rendering evaluation of therapeutic procedures quite difficult Most patients die of cachexia, or of intercurrent infections, or renal or cardiac failure, or amyloidosis

LABORATORY STUDIES

Proteins The incidence of Bence-Jones proteinuria varies greatly [3] Batts found it in 50 per cent of his 40 cases, Geschickter and Copeland in 65 per cent of a large group (over 400 cases), and Bayrd and Heck in 67 per cent of 83 cases The average incidence is probably 60 per cent The blood protein (notably the serum globulin) is often increased

Blood calcium may be normal or elevated Gutman and co-workers (13) found it elevated in 44 per cent of their cases, Bayrd and Heck in 20 per cent, Lichtenstein and Jaffe in 50 per cent

Inorganic phosphorus is rarely decreased and in the terminal stages may even be increased, the alkaline *phosphatase* content of the serum is seldom increased, the acid phosphatase is normal

General Blood Findings The hemoglobin, red cell count, total white count, and differential count are often within normal limits, but anemia tends to develop as the disease advances Occasionally myeloma cells enter the blood in sufficient numbers to give a leukemic picture (so-called plasma-cell leukemia)

Sternal Bone Marrow Findings The presence of myeloma cells in the sternal marrow is usually diagnostic of the disease However, since these tend to lie in clumps or nodules, a negative aspiration is possible even in a definite case of multiple myeloma Myeloma cells are large atypical plasma cells, with deep purple-staining nuclei and pale blue, faintly vacuolated cytoplasm Some are multinuclear, others have a perinuclear halo, some show signs of amitotic nuclear division

Bone and Soft-Tissue Tumors Biopsy of tumors in the bones and soft tissues will reveal myelomatous deposits

Roentgen Findings Roentgenograms of painful areas or sites of fractures in the early stages of the disease may reveal minimal decalcification of the bone, with no characteristic findings to permit differentiation from osteomyelitis, or from primary or metastatic bone tumor The subsequent pathologic changes may develop slowly or rapidly A single focus may be apparent for many months, or rapid development of multiple bone lesions may ensue These multiple lesions may or may not be symptomatic In typical and especially in advanced cases, there are multiple sharply demarcated circular areas of destruction in the skull, ribs, pelvis, and other bones Some patients die with few or no bone lesions demonstrable by x-ray examination

The differential roentgen diagnosis in the early stages of the disease is usually impossible We have seen cases, which eventually proved to be myeloma, diagnosed by experienced radiologists as simple fracture, Hodgkin's disease of bone, hyperparathyroidism, metastatic carcinoma, and osteomyelitis Conversely, cases of osseous leukemia, lymphoblastoma, tuberculosis, carcinosis, and hyperparathyroidism may be erroneously diagnosed (from bone films alone) as multiple myeloma Metastatic mammary carcinoma and osteomalacia are probably the most fruitful sources of confusion

X-RAY TREATMENT OF MULTIPLE MYELOMA

(*Review of the Literature*)

A review of the literature on the x-ray treatment of multiple myeloma has not been very informative Most articles merely mention irradiation as one form of

[3] In 1848, Bence-Jones (6) discovered a special protein in the urine of a patient suffering from a bone disease which caused softening and fragility of the skeleton (*mollities ossium et fragilitas*) In 1873 von Rustizsky (23) described multiple tumors of bone consisting of proliferating bone-marrow elements which erode the cortex and at times penetrate into the soft tissues In 1889 Kahler (15) concluded that the two findings existed together and described a clinical syndrome which bears his name and is characterized by deformation and abnormal fragility of the bones, bone pains, cachexia, and the presence of Bence Jones protein in the urine Subsequent experience has shown that this protein is occasionally found in patients with other types of bone destruction

therapy Belden (5) reported a case in which treatment with x-rays resulted in relief of pain only The technic used and dose given were not stated Stone (28) reported a similar case without technical irradiation data One of Meyerding's patients (19) received "x-ray treatment," but no further information is available

There are, however, some fairly complete references in the literature to solitary myelomas treated with x-rays Bailey (2) recorded a case followed for seven years in a female 65 years of age who had progressive pain in the right arm for one year and impairment of function for six weeks She was otherwise in excellent physical condition The blood count was within limits of normal and the urine was negative for Bence-Jones protein The biopsy diagnosis was plasma-cell myeloma The patient was given "2 5 erythema doses, 140 kv , 12 doses in two weeks " After six weeks, "three skin units" of the same type were given Roentgenograms six months later showed deposition of lime salts, with the bone assuming a normal appearance Films made after six years did not reveal any definite evidence of disease

Peyton (20) described a 42-year-old male with spastic paralysis of the lower extremities, loss of pain sensation below the level of T7, bilateral ankle clonus and spinal mass reflex in the lower extremities X-ray examination showed compression and rarefaction of T6 The disk between T5 and T6 was almost obliterated Laminectomy was performed, exposing the cord throughout the length of the tumor, about the height of one vertebra Microscopic examination revealed plasma-cell myeloma Eleven radium needles (65 mg) were inserted into the tumor and left for twenty hours, giving a total dose of 1,300 mg hr with 0 5 mm nickel steel as filter X-ray therapy was started thirty-five days later Four treatments in six days, 132 per cent of a skin erythema dose, were given to an anterior and the same dose to a posterior field (200 kv , 1 mm Cu plus 4 mm Al filter, 50 cm anode-skin distance) Four months after operation the patient could walk without crutches, eighteen months after therapy he was still symptom-free

Boidin *et al* (7) reported a case of osseous myeloma in which two large ulcerated and infected tumors on the head involved the calvarium The tumors were large, 10 cm thick and 47 cm in circumference at the base They were treated with a coil of Robiquet (25 cm spark, 6 mm Al filter, and an anode-skin distance varying from 30 to 50 cm) At each point treated, 500 to 1,000 "R" were given, repeated in the beginning every eight days, then every fifteen days The treatment continued at intervals for sixteen months The disappearance of the tumor was rapid, but it took months for the bone to regenerate Lacassagne (16) had one seven-year "cure" in 12 irradiated cases, the fate of the other 11 is not ascertainable

Batts (3) reported 23 cases of multiple myeloma treated with x-rays, with the following general technic high-voltage radiation, filter 0 9 mm Cu, 50 cm anode-skin distance, area varying from 100 to 400 sq cm , 200 r dose and 600 r to each area Pain was definitely relieved in 78 per cent of the cases, and there was improvement in paraplegia in 4 out of 5 cases For patients receiving x-ray therapy the average duration of life after admission was *twenty-three months* (23 cases), in contrast to *6 months* (17 cases) for those not receiving radiation

Toth and Wintermantel (29) report a case of a solitary myeloma with survival six years after the first appearance of symptoms The patient was a 53-year-old white female with pain in the right hip and thigh and inability to walk, which had been progressive for five years Roentgenograms showed "primary malignant bone tumor " The lesion progressed for the next year and a half without involving the lungs X-ray examination of the pelvis at that time revealed advanced destruction in the right innominate bone Irradiation was started on Oct 31, 1941—150 r on the skin (to a field 20 × 20 cm)—and "caused a marked febrile reaction " The skin dose was then reduced to 80 r Fifteen treatments were given, totaling 1,700 r through

three portals (200 kv p , 20 × 20 cm area, 50 to 70 cm anode-skin distance, h v l 2 0 mm Cu) Roentgenograms made two months later showed no change A second course of x-ray therapy comprised thirteen treatments totaling 1,700 r The unusual febrile reaction was again noted Films six months after admission showed considerable trabecular recalcification at the site of the previous destruction Another film two months later revealed further improvement of the pelvis, but the thorax showed numerous osteolytic lesions in the ribs, with two healing pathological fractures Tests for Bence-Jones protein were first positive on Oct 24, 1942, and the patient died on Oct 28, 1942, one year after radiation therapy was commenced and six years after the first appearance of symptoms in the right hip Histologic examination of the irradiated area revealed the presence of normal bone as well as osteoid tissue The marrow spaces were fibrotic in most areas, with occasional remnants of tumor cell collections [4]

Pohle (21) states that irradiation is the method of choice and is best given by the protracted-fractionated method with small fields to avoid general reaction and leukopenia "As myeloma is very radiosensitive, a total dose of 900 to 1,200 r in single doses of 180 r and distributed over ten to fourteen days, should be a sufficient amount of irradiation Smaller areas of bone involvement may be treated by a single dose of 600 r "

Coley (9), using toxin treatment alone, had 1 patient free from disease for five years and another for four and a half years With irradiation plus toxin, symptoms and clinical signs disappeared completely in 6 cases With irradiation, 1 patient was symptom-free for four years, and then had a recurrence with paraplegia, at that time toxin was used and an apparent cure was obtained for two and a half years With irradiation alone, myelomatous foci "disappeared" in 4 cases, for an unspecified number of months

[4] Note that tumor cells persisted despite fairly heavy dosage

Reinhard and his associates (22) did not find one case in which there was convincing objective evidence of improvement after radiophosphorus therapy One patient had relief from pain, but radiophosphorus could not be positively identified as responsible for this Radiophosphorus was believed to have significantly shortened life in 2 patients by producing a severe leukopenia and thrombopenia Radioactive strontium has been used (4) but nothing definite has yet evolved

Hall and Watkins (14) used radioactive phosphorus combined with x-ray therapy in one case of multiple myeloma, with apparent re-ossification of the tumor sites However, they warn against the danger of permanent hemopoietic damage from oral or parenteral irradiation

Snapper (27) has used "stilbamidine" and "pentamidine" in conjunction with a low animal protein diet in patients having multiple myeloma Pain was favorably influenced but relapses occurred No cases were cured Snapper believes, on the basis of 3 cases, that some patients "refractory to x-ray treatment may become susceptible to irradiation after the use of stilbamidine "

AUTHORS' SERIES

Since 1928 we have had in the San Francisco Hospital 18 traced cases of multiple myeloma, 11 with positive microscopic proof and the other 7 with sufficient clinical, laboratory and x-ray evidence to warrant acceptance of the diagnosis The average age at the time of diagnosis was 53 1 years, the range being from 31 to 72 years There were 11 males and 7 females One patient was colored, the rest white

The average duration of life after the diagnosis was established was 8 5 months in the proved cases, excluding one patient who has lived over nine years Still excluding this latter unusually favorable case, the average survival in the *x-ray-treated* group was 10 4 months, in contrast to 2 3 months in the untreated group

Admission Diagnoses Some patients were referred to the San Francisco Hospital

FIG 1, A L L F Male, 63 Multiple myeloma (primary focus probably in 5th lumbar body) Destruction of most of body of 5th lumbar vertebra See also Fig 1, B and C

after the diagnosis had been made elsewhere Other admission diagnoses were endocarditis, fractured femur, intestinal neoplasm, sternal tumor, sciatica, psychoneurosis, metastatic bone tumor, carcinomatosis of the lumbar spine, pathological fracture, pneumonia, extensive neoplastic or inflammatory process involving the bones

The chief complaints also varied Pain was present in 17 of the 18 patients, or 95 per cent Soft-tissue masses near the sites of the bone tumors were present in 4 cases, or 22 per cent Significant weight loss occurred in 2 patients, or 11 per cent Sudden acute pain with pathological fracture was seen in 3 patients, or 16 6 per cent Paralysis of the lower extremities developed in 2, or 11 per cent Each of the following complaints was present in 1 case chest pain, prolonged bleeding from the nose and alveolus (after dental extraction), dizzy spells

Laboratory Findings Bence-Jones protein was present in 6 of the 18 cases, or 33 per cent, it was present in 36 per cent of the proved cases Eleven patients had positive bone marrow biopsies The total serum proteins determined in 14 cases varied from 4 81 gm per cent to 14 05 gm per cent, 6 patients having a total protein of 8 0 gm per cent or over The blood calcium levels varied from 8 0 mg per cent to 12 1 mg per cent, 5 being over 11 mg per cent The blood phosphorus levels varied from 3 0 mg per cent to 4 8 mg per cent

X-ray Findings The bones involved, in order of frequency, were the skull (9 cases), ribs (9 cases), femora (7 cases), pelvis (6 cases), clavicles (6 cases), cervical, thoracic, and lumbar spine (5 cases each), scapulae (4 cases), humeri (4 cases) Multiple bony involvement was, of course, present in every instance

One case well exemplifies the interesting manifestations of this disease and will be mentioned here since it does not fall into our irradiated group (described elsewhere in this article, under Case Reports)

L L F, a white male, aged 63, was admitted to the hospital complaining of pain in the left knee and low back for four months X-ray examination revealed no evidence of disease in the knee, the body of the fifth lumbar vertebra was partly destroyed. Skull films disclosed a circular area of rarefaction in the right parietal bone about 3 cm in diameter The other bones and the lungs showed no lesions *Note* The ribs and pelvis were radiologically negative. The diagnosis was probable metastatic neoplasm See Fig 1, A and B

Laboratory Data Hemoglobin 58 per cent (8 59 gm), white blood count 7,050, serum calcium 11 2 mg per cent, phosphorus 4 0 mg per cent, blood protein, total 7 2 gm per cent (albumin 4 2 gm, globulin 3 0 gm), alkaline phosphatase 1 5 units (rising to 18 8 units six weeks after admission), icterus index (four weeks after admission) 22 units The urine was negative for Bence-Jones protein The sternal bone marrow contained 27 per cent abnormal plasma cells

The biopsy report on a soft-tissue mass over the skull defect was as follows "Sections reveal a rather edematous, fibrous stroma, throughout which there is a diffuse infiltration with plasma cells These exhibit the usual polygonal shape with eccentric nuclei and a peripheral arrangement of the masses of chro

Fig 1, B and C Same case as Fig 1, A B Circular area of bone destruction in right parietal bone The rest of the skeleton was negative Tentative roentgen diagnosis Metastatic neoplasm Biopsy of skull Plasma-cell myeloma
C Tissue from skull biopsy showing a rather edematous fibrous stroma diffusely infiltrated with plasma cells These exhibit the usual polygonal shape with eccentric nuclei and a peripheral arrangement of the masses of chromatin They vary considerably in size, many of them being quite large and a few containing multiple nuclei *Diagnosis* Myeloma

natin These cells vary considerably in size, many of them being quite large and a few containing multiple nuclei Several areas of the tissue exhibit hyaline changes, pyknotic nuclei, and necrosis *Diagnosis* Multiple myeloma " (See Fig 1, c)

The patient went rapidly down hill while the tissue just described was under study, and died of choleinia some six weeks after admission

Autopsy disclosed myelomatous lesions in the lumbar spine and skull, plus a mass in the head of the pancreas, compressing the common bile duct Microscopically the latter proved to be metastatic myeloma (Radiation therapy to the upper abdomen possibly *might* have prevented or deferred this fatal outcome by shrinking the pancreatic mass)

X-ray Treatment There were 8 proved cases treated with x-rays The average duration of life in 7 of these was 10 4 months following irradiation, 1 patient is still living and clinically well nine years after irradiation Three proved cases were not treated, the average duration of life in these was 2 3 months

Five patients with microscopically unproved but clinically definite myeloma were irradiated, and their average duration of life was 7 1 months Two were not treated, and the average duration was 36 3 months!

The physical factors were as follows 200 kv, h v l 1 2 mm Cu, target-skin distance and field size varied according to the sites treated (commonly used distances were 70 cm and fields 20 cm in diameter) The dose in roentgens was measured in air without back-scatter

The results of irradiation may be classified as subjective improvement, objective improvement, and no effect Subjective improvement resulted in 4 patients (relief of pain) Objective improvement occurred in 2 patients, both paraplegics (one regained sensory and motor power, one only sensory) No apparent improvement of any type was found in 7 cases, but in 1 of these irradiation was inadequate (refused by the patient after a single treatment, because of nausea) Partial recalcification of the lesions occurred in 1 case Therefore, of 13 cases treated, 6 showed improvement, and 7 did not The details of treatment are listed under the individual case reports and in Table I

CASE REPORTS

CASE 1 Mr G I, 31-year-old Peruvian, was admitted on Oct 19, 1929, complaining of difficulty in urination, paralysis of the legs, and severe pains in the back and flanks

Laboratory Data Hemoglobin 70 per cent (Sahli), red cell count 3,560,000, white cell count 8,000 (polymorphonuclears 82, lymphocytes 16, monocytes 2), blood Wassermann negative, no Bence Jones protein

X-ray examination of the skull was negative The cervical, thoracic and lumbar spine, pelvis, and upper femora showed areas of destruction

Clinical Diagnosis Multiple bone tumors either metastatic from prostate or due to multiple myeloma

X-ray Treatment 200 r to the lumbar spine

Patient refused further treatment, and died Nov 12, 1929

CASE 2 Mrs E O, 59-year-old Irish woman, was admitted on July 16, 1932, with a history of weakness for seven months, swelling of the head for three months, backache and pain in the right thigh for three months She was emaciated and pale, with a soft, non-tender 8 cm mass over the left parietal area and another small mass over the mid-occipital region

Laboratory Data Hemoglobin 54 per cent, red blood cells 3,000,000, total plasma protein 13 0 gm. per cent, no Bence-Jones protein

X-ray examination on July 20 showed a few indefinite areas of rarefaction in the ribs The lumbar spine was normal except for a questionable area of radiotranslucency in the body of L2 Views of the skull, clavicle, and right femur, on July 27, showed many radiolucent areas

Clinical Diagnosis Multiple myeloma

X-ray Treatment 600 r each to the anterior and posterior thorax and pelvis

No change was noted following therapy The patient died in six weeks, of bronchopneumonia

CASE 3 Mr L P, a 48-year-old Portuguese, was admitted on Feb 9, 1934, complaining of continuous alveolar bleeding following a tooth extraction on Jan. 4, 1934, intermittent epistaxis, pain in the right hip and lower lumbar region for four months

Laboratory Data Hemoglobin 33 per cent, red blood cells 1,700,000, white blood cells 8,600, with a normal differential count and an occasional myeloblast, Bence-Jones protein present.

X-ray examination of the skull and ribs was negative, compression of the body of L1 was demonstrated

Clinical Diagnosis "Endocarditis" and, later, multiple myeloma The radiology department suggested hyperparathyroidism

X-ray Treatment 750 r in five days over L1 posteriorly (for pain)

No apparent change followed treatment Death occurred in one month, due to bronchopneumonia.

TABLE I CASES OF MULTIPLE MYELOMA TREATED BY X-RAYS

Case	Sex and Age	Total Dosage (r air)*	Results	Survival
1	M 31	200 r, post , to lumbar spine (inadequate)	Signed release	0 7 mo
2	F 59	600 r, ant and post , to thorax, in 15 days 600 r, ant and post , to pelvis, in 15 days	No change	1 5 mo
3	M 48	750 r, post , over L5, in 5 days	No change	1 0 mo
4	M 59	1,000 r, post , to thorax, in 10 days	Pain relief	14 0 mo
5	F 51	October 1939 1,000 r, post , to thoracolumbar spine, in 19 days 1,000 r, ant to left hip in 19 days November 1939 400 r, post , to right hip, in 17 days 600 r, ant , to right hip, in 17 days 100 r, ant , to lumbosacral spine, in 17 days 200 r, post , to lumbosacral spine, in 17 days March 1940 200 r, ant , to left shoulder, in 18 days 200 r, ant , to left hip, in 18 days 100 r, post , to left hip, in 18 days 100 r, ant to pelvis, in 18 days 100 r, post to cervical spine in 18 days September 1940 600 r, to right neck and skull, in 3 days September 1942 1,000 r ant , to right lower femur, in 6 days 1,000 r, to right shoulder, in 6 days 100 r, to right frontal bone, in 6 days	Marked subjective improvement	46 0 mo
6	F 35	1,200 r, post , to L5, in 15 days 800 r, ant , to L5, in 15 days	No change	1 5 mo
7	F 57	2 400 r, ant , to thorax in 30 days 700 r, ant , to lumbosacral spine, in 4 days	Pain relief	12 0 mo
8	F 70	1,000 r, to right lat ribs, in 12 days 1,000 r, to left lat ribs, in 12 days 1,000 r, to lumbosacral spine, in 7 days	No change	6 5 mo
9	M 36	1,000 r, to right clavicle, in 6 days 1,000 r ant , to right pelvis, in 6 days 1,000 r, post , to pelvis, in 7 days 1,000 r, to right and left lateral skull, in 7 days 1,600 r, ant , to right and left shoulder, in 8 days 1,300 r, ant , to chest, in 7 days 1 400 r, ant to left hip in 7 days	No change	6 0 mo
10	F 70	500 r, ant and post , to chest, in 15 days 2,000 r, ant , to right hip, in 15 days 2 000 r, post , to C6, in 15 days	Improvement in pain	8 5 mo
11	M 69	2800 r, post , to lumbar spine, in 20 days	Improvement in sensation but not in motor function	2 5 mo
12	F 72	550 r, ant , to thorax in 5 days 100 r post , to thorax in 1 day	No change	1 5 mo
13	M 61	October 1939 1,900 r, ant , over T8 in 1 mo 1,900 r, post , over T8 in 1 mo July 1941 2,100 r, post over T8 in 10 days October 1941 600 r, post , to thorax, in 3 days	Return of sensation and motor function, recalcification of bone, marked improvement	Still living (over 9 yr)

* Fields usually large *e g* , 20 cm diameter, h v l 1 2 mm copper

CASE 4 Mr G P , 59-year-old Greek, was admitted on July 9, 1936, with a history of pain in the sternum, swelling at the right sternoclavicular junction, and pain in the right subscapular area of twelve months' duration The patient was thin and in moderate distress, the skin over the manubrium was edematous, red, and tender to pressure

Laboratory Data Hemoglobin 76 per cent, red blood cells 4,100,000, white blood cells 11,000, total plasma proteins 4 81 gm per cent, Wassermann reaction negative, Bence-Jones protein present

X-ray examination on July 13 showed radiolucencies of moderate extent in the skull and cervical spine and extensive bone destruction in the sternum.

Clinical Diagnosis Multiple myeloma

X-ray Treatment 1,000 r in air to the anterior chest, resulting in slight relief of pain

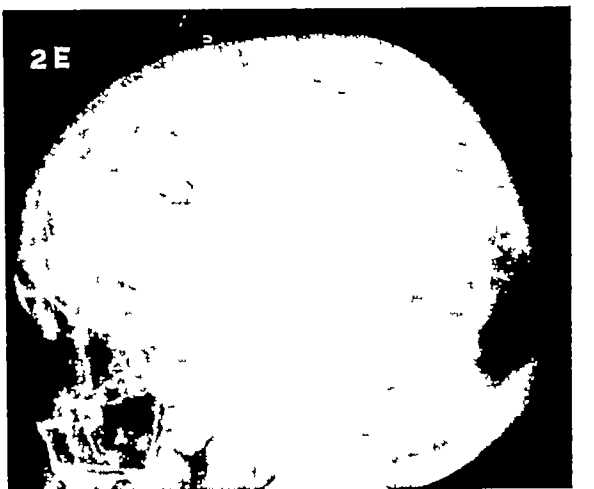
The patient died fourteen months after admission, from bronchopneumonia and uremia

CASE 5 Mrs M F , 51-year old white female, was admitted on Oct 5, 1939, complaining of pain in the right hip, thoracic spine, left lower ribs, and anterior

Fig 2 A, B C Case 5 M F Female, 51 Multiple myeloma (primary focus not discoverable multiple lesions when first seen)

A Destructive lesions in ribs and thoracic spine Pathological fracture of left 10th rib posteriorly Biopsy of the rib showed plasma-cell myeloma

B and C Pathological fracture left femur with healing following irradiation Remained healed for three and a half years *Note* A pathological fracture of the right femur in a similar location occurred approximately two years after the fracture of the left. See also Fig 2, D–F



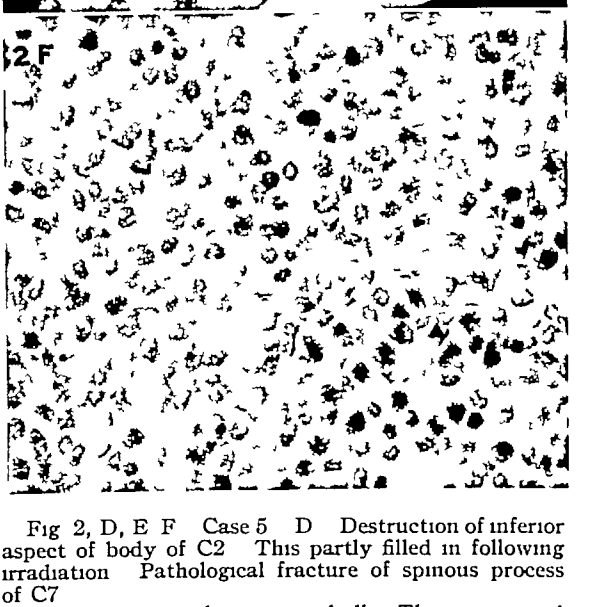


Fig 2, D, E F Case 5 D Destruction of inferior aspect of body of C2 This partly filled in following irradiation Pathological fracture of spinous process of C7

E Destructive lesions in skull These regressed partly following irradiation but finally grew in size in the frontal area (some three years after this film)

F Tissue from rib biopsy showing, scattered through the bone marrow, some large islets of discrete uniform, rounded pink cells with dark staining eccentrically placed nuclei Masses of plasma cells have locally crowded out the hemopoietic and myelocytic tissues *Diagnosis* Plasma-cell myeloma

part of the chest for four months She was a well developed, well nourished woman, lying quietly in bed but having considerable pain on movement

Laboratory Data Hemoglobin 80 per cent (11 5 gm), albumin 5 84 gm per cent and globulin 2 02 gm per cent, serum calcium 11 1 mg per cent, phosphorus 3 2 mg , phosphatase 2 23 units, cholesterol 148 mg per cent

A biopsy specimen from a rib was described as follows Scattered through the bone marrow are some large islets of discrete, uniform, rounded, pink cells with dark-staining, eccentrically placed nuclei Several of these cells have more than one nucleus, and occasionally there are mitotic figures There are masses of plasma cells They have locally crowded out part of the hemopoietic and myelocytic tissues The surrounding bone marrow shows myeloid and erythropoietic cells in the usual ratio, a moderate number of megalokaryocytes, and a moderate amount of granulation tissue, it is fairly active, however *Diagnosis* Plasma-cell myeloma of rib (See Fig 2, F)

X ray examination on Oct 6, 1939, showed two 2 cm areas of radiolucency in the left ilium, osteoporosis of the cervical and thoracic spine, radiolucencies in the skull and extensive radiolucent lesions in the ribs The findings on subsequent examinations were as follows March 25, 1940 Lumbosacral spine, increase in the rarefaction Nov 13, 1940 Pelvis, no change Nov 27, 1940 *Left* femur, pathological fracture March 8, 1941 Skull, no change, sternum negative April 12, 1941 Healed fracture of the femur July 18 and 21, 1941 Pathological fracture of the 6th rib and right acromion July 24, 1941 Skull, enlargement of lesions, humerus, multiple lesions, *right* femur, lesions with pathological fracture, pelvis, no change, hands and feet, negative

Clinical Diagnosis Extensive neoplastic process involving the bones

X-ray Treatment The first course in October and November 1939, over a period of nineteen days, consisted of 1,000 r to the posterior thoracolumbar spine and 1,000 r to the left hip anteriorly , second course, latter part of November and first part of December 1939 (17 days), 400 r to right hip posteriorly , 600 r to right hip anteriorly , 100 r anteriorly to the lumbosacral spine, and 200 r to the posterior lumbosacral

spine Marked subjective improvement followed these courses A third course, in March 1940 (eighteen days), consisted of 200 r to the left shoulder, 200 r to the left hip anteriorly, 100 r to the left hip posteriorly, 100 r to the pelvis, 100 r to the posterior cervical spine A fourth course, in September 1940 (three days), consisted of 600 r to the right lateral neck and skull

In November 1940 the patient was admitted with herpes zoster, and while she was in bed a pathological fracture of the left femur was noted This was treated with a hip spica She was discharged and observed periodically, but no further treatment was given, until September 1942, following occurrence of a pathological fracture of the right femur A dose of 1,000 r was then given to the lower anterior right femoral area in six days, then 1,000 r to the right shoulder anteriorly in six days, then 1,000 r to the right frontal bone in six days A phagedenic ulcer developed about a traction pin in the tibia in November 1942, and death occurred on March 6, 1943, of acute purulent meningitis Survival of *46 months*

CASE 6 Mrs M D, 35-year-old Irish female, was admitted on Feb 25, 1941, with back pain and left sciatica of four months' duration She had been seen in one of the University Out-Patient clinics for several weeks before entry, with a diagnosis of psychoneurosis

Laboratory Data Hemoglobin 94 per cent, red blood cells 5,050,000, total serum proteins 6 9 gm per cent, serum calcium 9 6 mg per cent, serum phosphorus 4 3 mg per cent, phosphatase 6 7 units, Bence-Jones protein present

A sternal marrow biopsy showed plasma-cell myeloma

X-ray examination on Feb 28, 1941, showed extensive areas of radiolucency in the skull, ribs, pelvis, and the body of L5

Clinical Diagnosis A diagnosis of multiple myeloma was made one week after admission Provisional diagnoses were numerous sciatica, peripheral neuritis, herniated nucleus pulposus, compression fracture, hysteria, cancer phobia, pelvic inflammatory disease, etc

X-ray Treatment 1,200 r to a 20-cm field centered over L5 posteriorly and 800 r anteriorly in fifteen days

The patient died on May 3, 1941, having survived 1 5 months after diagnosis Death was due to bronchopneumonia

CASE 7 Mrs M K, 57-year-old Negro female, was admitted on March 1, 1940, complaining of progressive pain in the back for many months and recent radiation of the pain down the right leg, also, swelling over the sternum for fourteen months The patient was a thin, elderly appearing woman in considerable pain A 6-cm mass was present in the supramanubrial area, with heavy pigmentation of the overlying and adjacent skin

Laboratory Data Hemoglobin 54 per cent, red blood cells 2,950,000, white blood cells 3,950, with a normal differential count, total blood proteins 14 5 gm per cent (albumin 3 27 gm, globulin 10.73 gm), no Bence-Jones protein

X-ray findings were as follows March 1, 1940 Sternum, osteolytic tumor of the manubrium sterni, most probably "chondroma or giant cell." March 6, 1940 Shoulder and elbow, negative. April 20, 1940 Skull, osteolytic lesions, pelvis, negative, lumbar spine, negative, thoracic spine, irregular decrease in density in T8 April 23, 1941 Chest, thoracic spine, and skull, no change Aug 15, 1941 Chest, negative, skull, no change, cervical spine and pelvis, negative Dec 11, 1941 Thoracolumbar spine, no change

Clinical Diagnosis Multiple myeloma

X-ray Treatment Between March 7 and 11, 1940, the patient received 1,200 r to the upper sternum this was repeated in twenty days There was some relief of pain and decrease in size of tumor Nine months later she received 700 r to the lumbosacral spine anteriorly Death occurred Dec 4, 1942, of bronchopneumonia

CASE 8 Mrs B V, 70 year-old Swiss female, was admitted on Sept 22, 1944, with back and flank pain of nine weeks' duration The patient had sustained a pathological fracture of the left clavicle one year earlier, which was treated by irradiation The diagnosis at that time was "chondroma"! Physical examination revealed pain on movement and a 5-cm. mass over the acromial end of the left clavicle.

Laboratory Data Hemoglobin 79 per cent, red blood cells 3,600,000, white blood cells 7,800, with normal differential count, total blood proteins 11 4 gm per cent (albumin 2 89 gm, globulin 8 6 gm), serum calcium 10 mg per cent, phosphorus 3 0 mg per cent, no Bence-Jones protein

Sternal biopsy showed plasma-cell myeloma.

Roentgen findings were as follows Sept. 29, 1944 Fracture of the 8th and 9th ribs, T10 and T11 wedge-shaped (myelomatous at necropsy) Oct. 4, 1944 Pelvis, including the upper femora and lower lumbar spine, multiple radiolucencies varying from 2 to 3 mm in diameter, similar lesions in ribs, scapula, cervical spine, and clavicles Oct. 10, 1944 Skull, multiple radiolucent areas up to 1 cm. in diameter Jan 9, 1945 Marked progression of the lesions in the pelvis, thoracolumbar spine, and ribs, the last showing multiple fractures

Admission Clinical Diagnosis Bone tumor, possibly multiple myeloma, with pathological fractures

X-ray Treatment 1,000 r each to the right and left sides of the thorax in twelve days, 1,000 r to the lumbosacral spine in seven days

There was no marked improvement, and the patient died on March 29, 1945, of bronchopneumonia. Necropsy confirmed the diagnosis of multiple myeloma

CASE 9 Mr J O, a 36-year-old white male, was admitted on Dec 23, 1944, having broken a leg, slipping on a curb

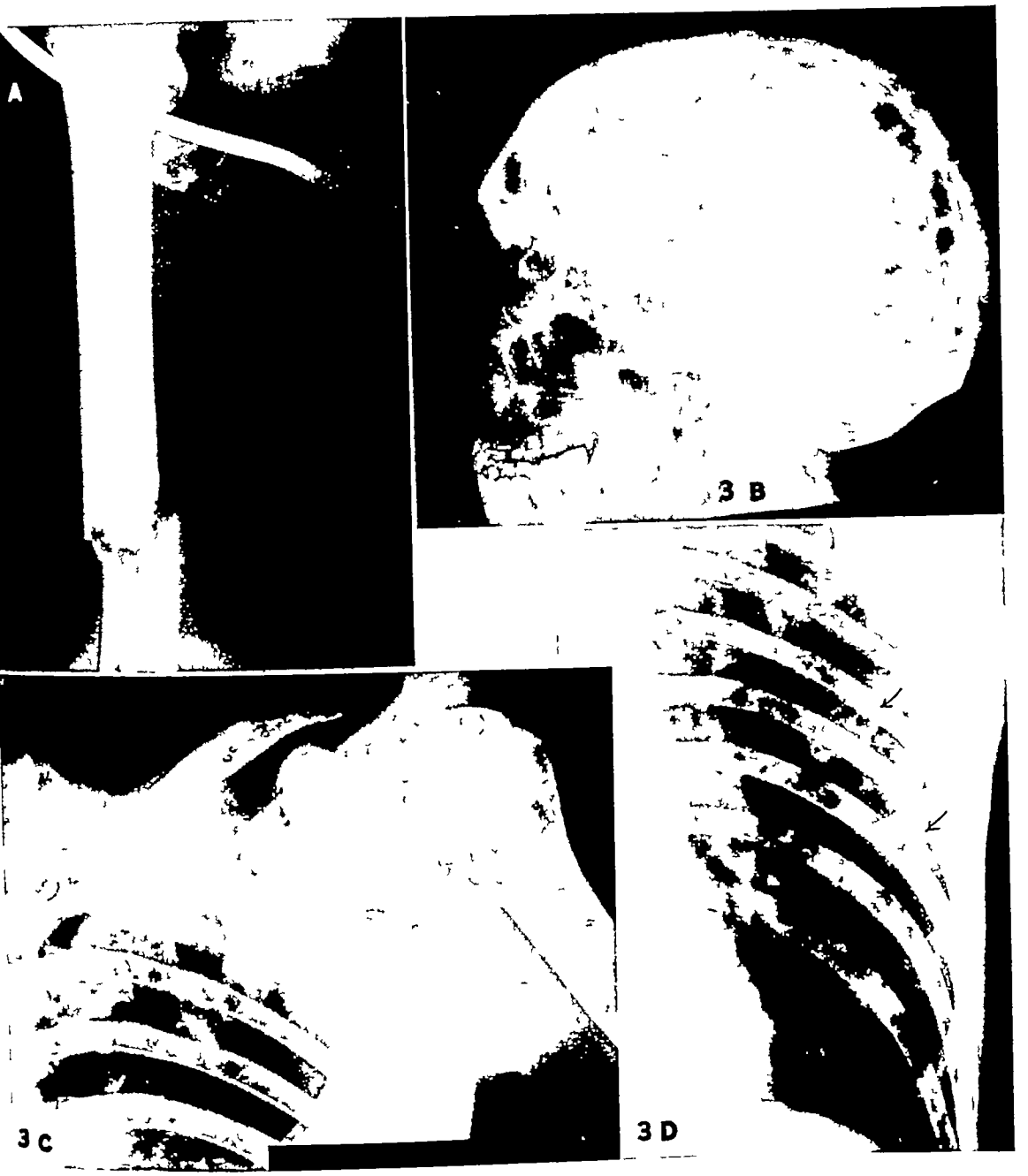


Fig 3 Case 9 J O Male, 36 Multiple myeloma (primary focus apparently in femur, 'metastasizing" after four months)

A Pathological fracture shaft of right femur Film made six days after entry, admission film showed minimal destruction, present film shows extensive bone destruction about fracture site (first apparent focus in this case)

B Skull five months after admission "Typical' myelomatous lesions Films at admission were negative

C Left shoulder, 6 months after admission Multiple destructive lesions in clavicle, scapula, humerus, and ribs

D Ribs six months after admission Multiple lesions Six weeks previously rib films were negative

Laboratory Data Hemoglobin 76 per cent, red blood cells 3,700,000, white blood cells 13,800, with normal differential count, total blood proteins 6 7 gm per cent (albumin 3 2 gm , globulin 3 5 gm), serum calcium 11 3 mg per cent, phosphorus 4 8 mg per cent, no Bence-Jones protein

A biopsy specimen from the right femur revealed plasma-cell myeloma

Roentgen examination on Dec 23, 1944, showed a pathological fracture of the shaft of the right femur in good position Films of the skull (Jan 4, 1945) were negative.

Frozen section of the leg lesion on Jan 27 showed "undifferentiated malignant tumor," and a subtrochanteric amputation was done Further *x ray findings* were as follows April 9, 1945 Chest, clear, pelvis, areas of decalcification in the right pubic bone, stump of the femur, and both ilia April 14, 1945 Skull, many radiolucencies, ranging from 2 to 20 mm in diameter April 20, 1945 Multiple radiolucencies in clavicles, scapulae, humeri, and ribs

Clinical Diagnosis Multiple myeloma

X-ray Treatment 1,000 r to the right shoulder anteriorly in six days, 1,000 r to the right pelvis anteriorly in six days, 1,000 r to the posterior pelvis in seven days, 1,000 r to the right and left lateral skull in seven days, 1,600 r to the right and left shoulder in eight days, 1,300 r to the chest anteriorly in seven days, 1,400 r to the left hip anteriorly in seven days

Treatment was followed by a decrease in pain in the shoulders, left hip, pelvis, and chest Death occurred on June 21, 1945, from uremia

CASE 10 Mrs C S, a 70 year old Irish female, was admitted on July 24, 1945, because of chronic nausea and anorexia, 60 pound weight loss in eight months, and chest pain for six months

Laboratory Data Hemoglobin 54 per cent, red blood cells 2,700,000, white blood cells 5,360, with normal differential count, total blood proteins 7 2 gm per cent (albumin 2 7 gm, globulin 4 5 gm), Wassermann reaction negative, no Bence-Jones protein

A sternal marrow biopsy showed plasma cell myeloma

X-ray Findings July 25, 1945 Chest, multiple areas of rarefaction in the right clavicle, left scapula, humerus, and ribs, with a fracture of the right 7th rib Aug 2, 1945 Skull, multiple radiolucencies, lumbar spine, negative Oct 24, 1945 Radiolucencies in the femora, lumbar spine, and pelvis, with a fracture of the pubic bone Nov 21, 1945 Pelvis, no change Dec 13, 1945 Cervical spine and mandible, multiple lesions March 13, 1946 Pathological fracture of the left humerus

X-ray Treatment 2,000 r to the right hip anteriorly in fifteen days, 500 r each to the anterior and posterior thoracic area in fifteen days, 200 r to the posterior cervical region in fifteen days

Some relief of pain followed Death, due to bronchopneumonia occurred March 18, 1946

CASE 11 Mr L R, 69-year old white male, was admitted on Nov 7, 1946, complaining of sudden pain in the back while stooping over a wash basin, causing him to fall to the floor Physical examination showed paralysis of both legs, bladder, and bowel, and sensory loss up to the mid-thigh

Laboratory Data Hemoglobin 11 8 gm (74 per cent), red blood cells 3,780 000, white blood cells 8,500 (polymorphonuclears 58, lymphocytes 40, basophils 2), Wassermann reaction negative, total blood proteins 7 6 gm per cent (albumin 5 9 gm, globulin 1 7 gm), serum calcium 8 mg per cent, phosphorus 4 7 mg per cent, alkaline phosphatase 5 5 Bodansky units, Bence-Jones protein present on one occasion

Sternal biopsy revealed plasma cell myeloma.

X-ray Findings Skull negative Pathological fracture of several ribs Some destruction of T11 and L2

Clinical Diagnosis Multiple myeloma

X-ray Treatment 2,800 r to the spine in approximately three weeks, followed by some improvement in sensation only

Death ensued Dec 28, 1946, from anemia and cachexia

CASE 12 Mrs K G, 72 year-old white female, was admitted on July 17, 1941, complaining of "rheumatic" pains in both shoulders, radiating to the hands, for eighteen months

Laboratory Data Hemoglobin 23 per cent, red blood cells 1,200,000, white blood cells 9,500, Wassermann reaction negative, 70 per cent Bence-Jones protein in urine, blood urea nitrogen 136 mg per cent Sternal biopsy showed 50 per cent plasma cells Subsequent laboratory findings were hemoglobin 59 per cent (10 gm), red blood cells 4,200,000, white blood cells 4,600 (polymorphonuclears 78 per cent lymphocytes 18 per cent, myelocytes 4 per cent) In one month the red cell count dropped to 1,070,000 and the hemoglobin to 17 per cent. Serum protein 8 gm per cent, calcium 10 mg, phosphatase 3 4 units

X-ray Examination Skull, chest and pelvis, negative

Clinical Diagnosis Multiple myeloma

X ray Treatment 550 r to the anterior chest and clavicles in five days, then 100 r posteriorly

Pain was not relieved and death occurred Aug 21, 1941, from cardiac failure

CASE 13 Mr J P, 61-year old white male, was first admitted to the medical service of the San Francisco Hospital on May 14, 1939, with chills, fever, and chest pains of two weeks' duration Physical examination revealed dyspnea, generalized chest pain, dullness over the right upper lobe anteriorly and posteriorly, blood pressure 110/80, temperature 103 6° X-ray examination on the day of admission showed consolidation in the lower portion of the right upper lobe, presumably lobar pneumonia

Neufeld examination of the sputum for pneumococci was negative Blood culture after one week showed no growth but later (twelve days after admission) yielded an unidentified gram negative rod. The blood Wassermann reaction was negative. The hemoglobin was 80 per cent, red blood cells, 4,000,000, white cells 16,000 The urine showed albumin (type unspecified)

The clinical diagnosis was lobar pneumonia The course was complicated by a pleural effusion and a lung abscess On July 13, 1939, the patient was discharged as improved

On Sept 30, 1939, the patient was re admitted complaining of abdominal pain and postprandial

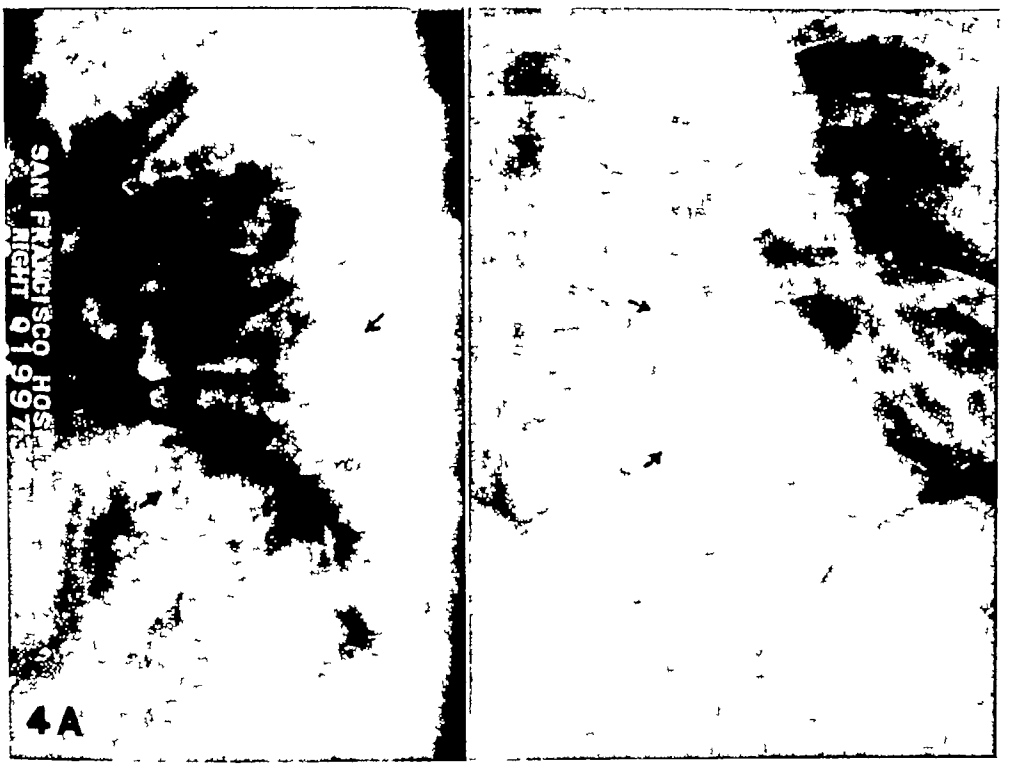


Fig 4 A, Case 13 J P Male, 61 Multiple myeloma Destruction of body of T8 and expansile lesion of adjacent left 8th rib (1939) See also Fig 4, B–G

distention for three months, a feeling of numbness over the abdomen and legs, and stiffness of the legs for one month, inability to walk and bladder difficulty for five days

The positive neurological findings at this time were (1) flaccid paralysis of both legs, except for slight ability to flex the thighs on the trunk, (2) knee and ankle jerks equal and hyperactive, (3) ankle clonus on the right, (4) positive bilateral Babinski sign, (5) cremasteric and abdominal reflexes absent, (6) absence of pain sense up to T8, (7) diminution of vibratory sense in the legs, (8) lower extremity touch sense intact, (9) distention of the bladder, (10) palpable spinal kyphos with crepitation in the region of the 7th and 8th thoracic vertebrae

Laboratory Data Blood Wassermann negative, urine negative for Bence-Jones protein, red blood cells 4,700,000, hemoglobin 85 per cent, white blood cells 8,100 (polymorphonuclears 61, lymphocytes 38, eosinophils 1), serum proteins 8 65 gm per cent (albumin 3 88 gm , globulin 4 77 gm), blood phosphorus 3 2 mg per cent A lumbar puncture revealed an initial pressure of 140 mm water Jugular compression reproduced pain in the legs but no rise in pressure Pandy 2 plus Lange 0012333211

Clinical Diagnosis Incomplete transverse myelitis at the level of T8

X ray examination, in October 1939, showed a destructive lesion with compression of body of T8 and a large expansile lesion in the adjacent posterior third of the left 8th rib The skull was negative

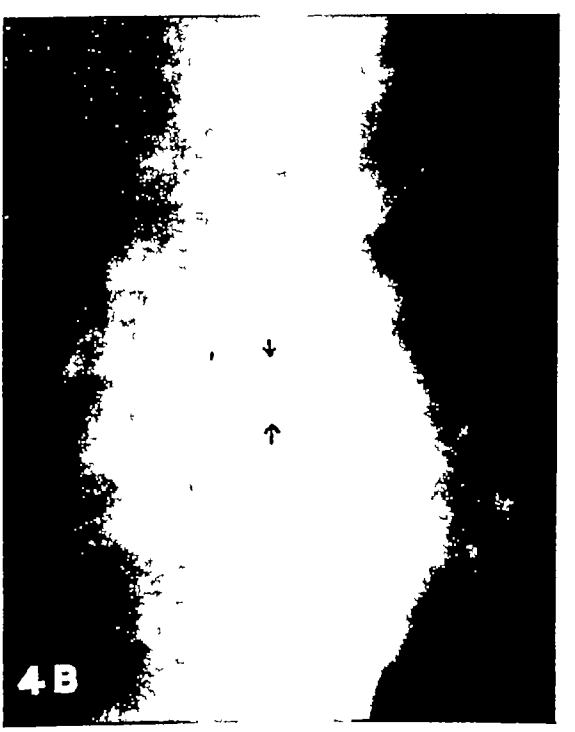


Fig 4 B Case 13 seven years after Fig 4, A showing some recalcification in the lesions involving T8 and left 8th rib (not well shown in this reproduction) New lesions present in other thoracic bodies and ribs See also Fig 4 C–G

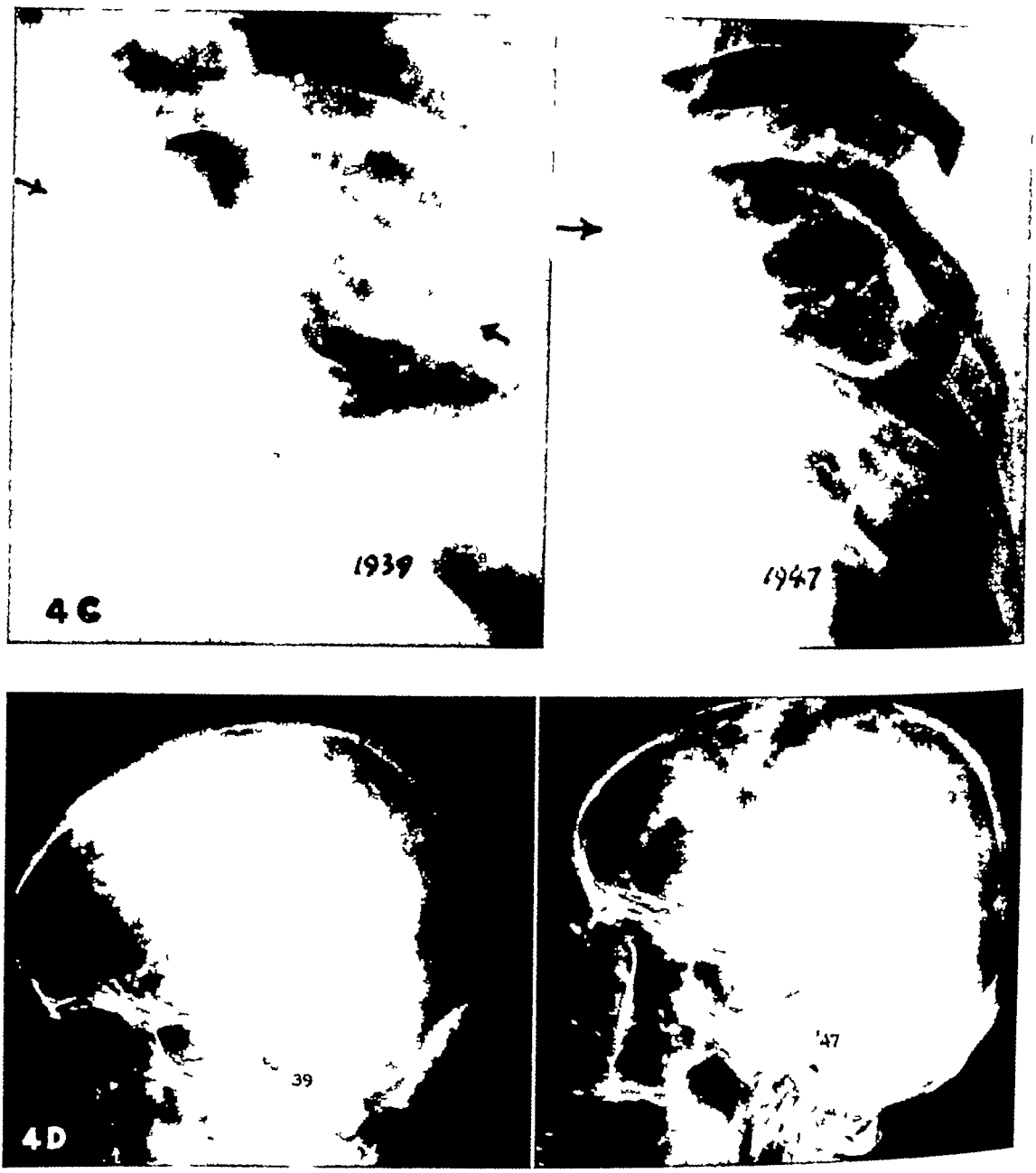


Fig 4, C and D Case 13 C Left 8th rib before treatment and again eight years later, showing partial recalcification Also healed fracture of left 7th rib
D Skull in 1939 and 1947 showing development of myelomatous foci

The pelvis and right femur showed several small areas of decreased density

The patient was placed in a posterior shell cast On Oct 21, 1939, a rib biopsy was performed by Dr Halter, and grossly the lesion appeared to be a sarcoma or myeloma Considerable bleeding was encountered during the procedure The pathological report was as follows The section shows a dense mass of cells scattered uniformly throughout a scanty, relatively vascular stroma No bone or normal marrow is seen The majority of the individual cells have moderately large, oval to round, dark nuclei with fine chromatin network and very scanty pink cytoplasm There is a moderate variation in size and shape of the cells There are no true plasma cells but occasional cells with dark, round, eccentrically placed nuclei Some cells contain two large nuclei *Diagnosis* Myeloma, rib (myeloblastic type) (See Fig 4 F)

On Oct 25, 1939, deep roentgen therapy was begun In approximately thirty days 1,900 r (in air) were given to the anterior and 1,900 r to the posterior thorax, over a circular field 20 cm in diameter (distance 70 cm , h v l 1 2 Cu) centered over TS

On Nov 12, 1939, the patient was able to wiggle the toes of both feet, slightly dorsiflex the feet, flex

Fig 4 E Case 13 Pelvis in 1947, showing multiple foci

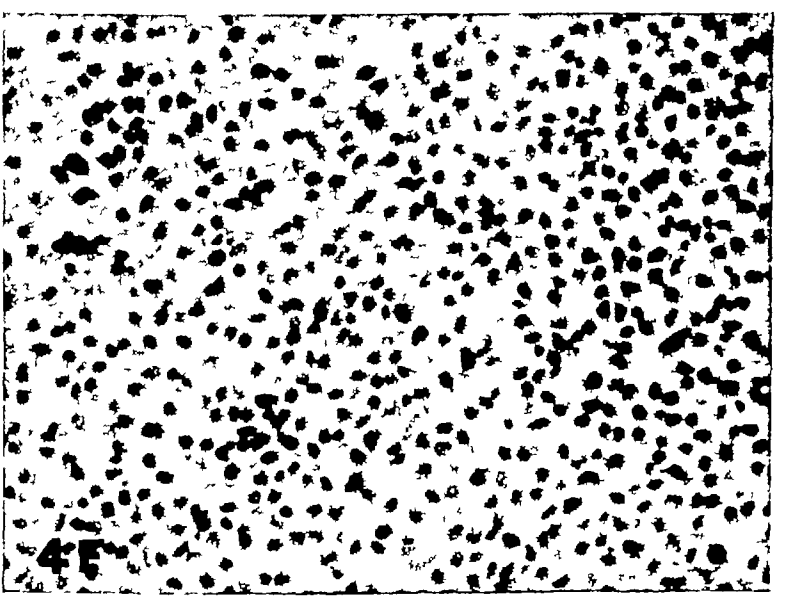


Fig 4 F Case 13 Tissue from rib showing numerous cells, a majority of which have moderately large, oval to round, dark nuclei with a fine chromatin network and very scanty pink cytoplasm There is a moderate variation in size and shape of the cells There are no typical plasma cells but occasional ones with dark round, eccentrically placed nuclei some contain two large nuclei Diagnosis Myeloma rib (myeloblastic type)

the right knee, abduct the right leg at the hip, and move both legs slightly in extension from a flexed position He gradually improved and was discharged on Jan 3, 1940

X-ray examinations in November and December 1939 showed apparent progression of the left 8th rib lesion and development of new areas of rib destruction elsewhere The spine showed no change

The patient dropped from sight and was recorded in our files as probably dead On June 30 1941, he

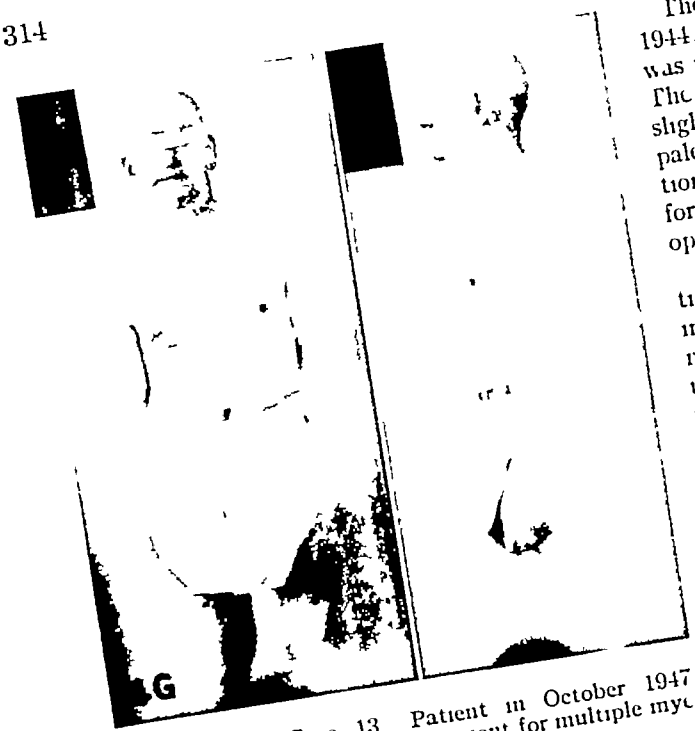


Fig 4 G Case 13 Patient in October 1947 eight and a half years after treatment for multiple myeloma with paraplegia Clinically well

came in, walking, complaining of stiffness in the left foot and pain in the back Films showed further compression of T8 The margins of T7 and T9 were now involved The large lesion in the left 8th rib showed partial bone regeneration A second course of radiation was given 2 100 r (in air) in ten days to the posterior thorax centered over T8 with the same factors as before

By August 1941, the patient was walking and looking better He gained four pounds by Oct 2, 1941 During the latter part of October, however, he hurt his back trying to lift a man! X ray examination revealed some molding of T12, but no change in T8 The posterior thoracic area was given 600 r in three days, with the same factors as previously

On Nov 14, 1941, a plaster cast was applied to the lower thorax and abdomen The urine at this time was still negative for Bence Jones protein

On Jan 12, 1942 the pain had practically disappeared and the patient was anxious to have the cast removed, this was done the following day and films of the spine showed more compression of T12 than had been apparent on Oct 30, 1941 There was some recalcification of the body of T8 and of the left 8th rib

The patient was discharged and followed at short intervals in the Outpatient Department In March he remarked 'If I were just a little stronger, I would get a job in the shipyards' In May 1942 he was seen again and was doing well He had hurt his left chest two weeks earlier, jumping over a creek(!), but continued to do well except for another attack of pneumonia in July 1942 In February and June 1943, films of the cervical spine were negative, the thoracic spine showed no significant change

The patient was not seen again until March 18 1944, he felt well and additional irradiation therapy was not considered to be necessary at the moment The skin over the treated area on the back w slightly telangiectatic and atrophic, anteriorly it w pale but showed no other changes X ray examina tion in December 1946 showed skull involvement for the first time New radiolucent areas had devel oped in the spine and ribs

In January and again in November 1947, the pa tient reported in response to follow up letters, look ing and feeling well He had been working as a night watchman Laboratory examination in Jan uary revealed hemoglobin 82 per cent (14 0 gm.) red blood cells 4,200,000, white cells 8,000 (poly morphonuclears 64, lymphocytes 25, eosinophils myelocytes 7) The urine was negative for albumin sugar, acetone and Bence-Jones protein Films the skull, spine, ribs pelvis, and upper femora vealed many new radiolucencies The spinal and rib lesions in the irradiated area were partly recalci fied The blood calcium was 9 4 mg per cent, phos phorus 3 0 mg per cent, total protein 8 35 gm per cent, (albumin 3 58 gm , globulin 4 77 gm)

DISCUSSION

The consensus of opinion in the general radiological literature is that "multipl myeloma is a radiosensitive lesion" Mos authors stop with that statement and c no really convincing evidence with whi to support it

In addition to the authors to whom ref erence has been made (Shields Warren, 28, Ackerman and del Regato, 1, Pohle, 21), Leucutia, and several other radiation ther apists (3, 10, 19) have displayed rather op timistic attitudes toward the radiation re sponsiveness of this disease However, in a recent refresher course summary (Am J Roentgenol 58 247, 1947) we note tha Leucutia has expressed a more cautious a titude, as follows "Radiation therapy leads to *limited* symptomatic relief, but no cure is possible"

Ehrlich (10) comes close to our own atti tude when he writes "X-ray treatment aids the clinical symptom of bone pain when present, and may temporarily retard the progressive bone destruction Prog nosis is still very poor"

One might expect some correlation be tween irradiation dosage and results The more adequate dosage (up to reasonable limits, say 2,500 tissue roentgens tumor

TABLE II SUMMARY OF RESULTS OF ROENTGEN TREATMENT

Case	Microscopic Findings (Type of Myeloma)	Maximum Tissue Dosage to Any One Lesion (Calculated to Middle of Principal Tumor in Area Treated)	Results and Duration of Life After Diagnosis	
1		200 r in 1 day to lumbar spine	None (inadequate dosage)	0 7 mo
2		1 000 r in 15 days to thorax and pelvis	No change	6 wk.
3		700 r in 5 days to L5	No change	4 wk.
4		830 r in 10 days to posterior thorax	Pain relief	14 0 mo
5	Plasma-cell	1,000 r in 19 days to lower thoracic and upper lumbar spine	Marked subjective improvement	46 0 mo
6	Plasma-cell	1,660 r in 15 days to L5	No change	1 5 mo
7		1,992 r in 11 days to anterior thorax	Pain relief	12 0 mo
8	Plasma-cell	1,000 r in 4 days to the lumbosacral spine	No change	6 5 mo
9	Plasma cell	1,892 r in 8 days to the shoulders	No change	6 0 mo
10	Plasma-cell	2,240 r in 15 days to C6	Pain relief	8 5 mo
11	Plasma-cell	2,800 r in 20 days to lumbar spine	Improvement in sensation	2 5 mo
12	Plasma-cell	540 r in 15 days to thorax	No change	1 5 mo
13	Myeloblastic	2 660 r in 30 days to T8	Return of sensation and motor function, recalcification of bone, marked improvement	Still living, over 9 yr

dose in a period of two to four weeks) might be expected to give improved results A review of the literature and study of our own dosage-result tabulation (Table II) suggests that such is not the case Some authors maintain a preference for moderate dosage (200 r × 3 in one week), others would give radiation to tolerance (200 r × 20 to each area) The answer to this problem is not yet available "Solitary" myelomas appear to merit intensive treatment, multiple myelomas with spinal cord compression probably benefit from fairly heavy dosage (*e g*, Case 13, above), multiple myelomas with pain over the involved flat bones or extremities may often be handled fairly well with moderate dosage (*e g*, Case 5, above)

SUMMARY

The authors review the results of x-ray treatment of multiple myeloma as reported in the literature, and in a series of 13 cases treated at the San Francisco Hospital Six of these cases showed improvement, 6 were not appreciably benefited, 1 had incomplete treatment

One of the patients survived over nine years and is still living, he is ambulatory and in good clinical condition, despite an initial grave paraplegia The average survival for the remaining proved x-ray-treated cases was 10 4 months, while that of the untreated cases was only 2 3 months

These results are distinctly inferior to those of Batts (3), who reported a survival period of 23 months in a roentgen-irradiated group and 6 0 months in an untreated group This difference may be due to variation in the stage of the disease in the two groups, plus variation in the roentgen dosage in some of the authors' cases

It is believed that adequate irradiation of patients with multiple myeloma is still worth attempting, though the results will unquestionably disappoint those who accept commonly published statements that these lesions are "very radiosensitive"

CONCLUSIONS

Multiple myeloma is not a very radiosensitive disease The average duration of life after diagnosis was 10 4 months in all but one of the authors' treated cases In this latter case there was a survival of over nine years and the patient is still living, exemplifying the good result one may occasionally obtain in the treatment of this disease

"Solitary" myeloma appears to be a radiosensitive and radio-controllable disease in certain instances, and should be treated by vigorous roentgen irradiation when the diagnosis is established microscopically

Multiple or "solitary" myeloma with spinal cord compression and paresis or paraplegia appears to be well worth irradiation (following laminectomy) In the

literature, survivals for as long as seven years have been recorded The authors' patient who survived nine years was in this group He is clinically well, though with extensive roentgenographic evidence of myelomatosis

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DISCUSSION

Grantley W Taylor, M D (Boston, Mass) I feel flattered to be invited to discuss Dr Garland's paper, although I do not pose in any way as an authority in myeloma I have followed these cases for many years at Huntington Hospital and Massachusetts General Hospital and I confess, after a long period of observation, to being completely confused as to myelomas

I am glad Dr Garland expressed a note of caution and I am entirely in agreement with him that these tumors are not especially sensitive to radiation. Our own experience has led us to a good deal of pessimism Irradiation is the only effective medium of therapy in myeloma that we have and therefore we use it, but we do not often see very satisfactory or very brilliant results It may be that the cell type, to which attention has been drawn, is of a good deal of significance It is interesting that Dr Garland's one case with so long a survival and so striking a reaction to treatment proved to be of a type other than the usual plasma-cell myeloma

The stilbamidine which we hailed with so much enthusiasm a year or so ago has washed out for us pretty much We do not feel that it does enough good to warrant pursuing its use to a very considerable extent

Dr Garland perforce, because of the brevity of the time, had to pass over some of the things which were included in his paper, to which I will just refer One is the laboratory aids to diagnosis Bence Jones protein, in our experience, as in his, is a rare and freakish type of finding When it is present it is of some help although it is not pathognomonic, in most of the cases it seems to be absent or you have to make frequent observations to discover it The level of protein is of much more significance and we find, as did he, that in almost all cases there is a considerable elevation of total protein and a reversal or a change in the albumin globulin ratio

The difficulty is that in myeloma we are dealing with a process we do not well understand, our standards for the life history of the disease are not well established and not standardized and in many cases

there are not true spontaneous remissions and regressions, but merely spontaneous episodes of a sense of well being in the patient only to be followed by an apparent retrograde activity in the disease I think the more observations that can be made on the variations in the natural history of this disease and on the correlation of these variations with the cell type, the better off we may be

SUMARIO

Roentgenoterapia del Mieloma Múltiple

Los AA repasan el resultado obtenido por la roentgenoterapia en el mieloma múltiple, tal como aparece en la literatura y en una serie de 13 casos tratados en el Hospital de San Francisco De estos últimos casos, 6 mostraron mejoría, 6 no se beneficiaron apreciablemente, y en 1, el tratamiento fué incompleto

Uno de los enfermos todavía vive, al cabo de más de nueve años, puede andar y se halla en buen estado clínico, a pesar de una grave paraplejía inicial La sobrevivencia media para los demás casos reconocidamente tratados con los rayos X fué de 10 4 meses, comparado con no más de 2 3 meses para los casos no tratados

Este resultado es decididamente inferior al conseguido por Batts, quien comunicó un período de sobrevivencia de 23 meses en un grupo irradiado con rayos X y de 6 0 meses en otro no tratado Esta diferencia puede deberse a hallarse la enfermedad en distintos períodos en los dos grupos, y además a variación en la dosis roentgenológica en algunos de los casos de los AA

Parece que todavía vale la pena probar la irradiación adecuada en el mieloma múltiple, aunque los resultados decepcionarán sin duda a los que aceptan los asertos corrientes de que dichas lesiones son "muy radiosensibles" En el mieloma múltiple o solitario con compresión de la médula espinal y parálisis o paraplejía, en particular parece que vale la pena ensayar la irradiación (consecutivamente a la laminectomía) En este grupo se han comunicado en la literatura sobrevivencias hasta de siete años, y la sobrevivencia prolongada descrita en la serie de los AA fué en un caso de este género El mieloma solitario parece ser radiosensible y radiocoercible en ciertos casos y debe ser tratado con la irradiación enérgica, una vez establecido microscópicamente el diagnóstico

Histologic Changes in Squamous-Cell Carcinoma of the Mouth and Oropharynx Produced by Fractionated External Roentgen Irradiation[1]

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MOST HISTOLOGIC studies of irradiation changes have been based on the effect of a single massive radium exposure producing overwhelming destructive changes in the tumor Few histologic studies have been made of the effects of fractionated roentgen irradiation, although this method predominates in modern radiotherapeutic technics The administration of roentgen rays in small daily fractions permits the normal epithelium to recover somewhat each day from the irradiation injury, while the less differentiated tumor cells, for the most part, show no evidence of recovery Fractionation also increases the number of times each tumor cell is exposed to irradiation while in the premitotic or mitotic phase, which is believed by many to be the most radiosensitive phase

Melnick and Bachem (1) described the findings in transplantable tumors of rats following both the single massive dose method and fractionated, protracted irradiation With the massive dose method, they noted radiation necrosis of tumor cells, associated with hyperemia, cellular infiltration, granulation tissue proliferation, fibrosis, and blood vessel changes With the fractionated protracted technic they observed, in addition to necrosis of radiosensitive cells, a gradual transformation of all the refractory tumor cells into hyperchromatic giant cells These cells did not degenerate by necrosis, but by calcification of the nucleus This method of treatment had no apparent effect on the adjacent normal tissues There was no fibrosis and no blood vessel damage

Halley and Melnick (2) described the changes observed in twenty-one breasts that were irradiated preoperatively Their findings were similar to those observed in animal tumors

Glucksmann (3) studied the effects on human squamous-cell and basal-cell carcinoma of different technics of fractionated roentgen and gamma-ray irradiation with varying daily and total doses He evaluated in each biopsy specimen the dividing, degenerating, resting, and differentiating cells The dividing cells showed rapid and early reduction of the number of mitotic figures, which often reached zero in eighty minutes Later there was partial resumption of mitotic activity, chiefly in the form of abnormal mitoses Many of these "broke down," contributing to the "degenerating cell" count, that increased until mitotic activity ceased In successfully treated carcinoma, mitotic division ultimately ceased Reduction of the number of resting cells in the growing areas of the tumor was due either to degeneration or differentiation Increased differentiation of the cells in most cases was related to a fall in the resting cell count Glucksmann (3) regarded many of the monster-sized cells as differentiating cells, this is contrary to our impression He concluded that the aims of treatment were to cause disappearance of the malignant dividing cell, produce a high degenerate cell count, reduce the number of

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non-dividing resting cells, and to increase the number of differentiating cells at the expense of the resting cells In summary, he stated that the success of irradiation is best evaluated by comparing the number and character of young cells surviving at stated intervals after irradiation

The purposes of this study are (1) to describe and evaluate the histologic changes occurring in irradiated squamous-cell carcinoma of the mouth and oropharynx, (2) to describe certain other attendant phenomena, such as radiation keratogenesis and the mechanism of formation of the various types of giant-sized tumor cells, (3) to illustrate schematically the probable mechanism of radiation degeneration of radiosensitive, moderately radiosensitive, and radioresistant squamous cell carcinoma, (4) to study the effect of irradiation on the stroma, (5) to study the effect of inadequate irradiation

MATERIALS AND METHODS

The material studied was obtained from 28 patients with squamous-cell carcinoma of the mouth and oropharynx, who were subjected to periodic biopsies during treatment The 28 cases are grouped according to anatomic location and clinical radiosensitivity as shown in Table I

TABLE I CLASSIFICATION OF TUMORS ACCORDING TO SITE AND RADIOSENSITIVITY *

Location	Radiosensitive	Radioresistant
Soft palate	1	1
Floor of mouth	5	1
Retromolar	1	3
Tonsil	4	2
Antrum	1	0
Tonsillar pillar	2	3
Alveolar ridge	0	1
Tongue	0	3

* Radiosensitive tumors are those that apparently disappeared completely after external irradiation Radioresistant tumors are those that failed to disappear completely after external irradiation

Irradiation Procedures

Beginning in 1932, a carefully controlled group of patients with carcinoma of the upper respiratory tract was treated with a standard irradiation technic at Bellevue Hospital The reactions of the tumor, skin, and mucosa to this irradiation have been recorded in graphic form (Figs 1 and 2) and analyzed (4, 5) From this series, 28 lesions in which serial biopsies were performed constitute the basis for this study

In the administration of fractionated external irradiation with high-voltage roentgen rays (200 kv , 0 5 to 2 0 mm copper filter), the two most important factors are the size of the daily tumor dose and the number of days over which the treatment is given With this in mind, two technics were employed a standard technic capable of destroying a carcinoma, a substandard technic entailing one-half of the daily dose of the standard technic The total dose was the same with both methods

Because of the irregular configuration of the mouth, jaw, and neck, any attempt to indicate the actual daily dose delivered into the tumor is an approximation The average total skin dose delivered in twenty-five to twenty-eight days was 4,000 r (measured with back-scatter) to each of two lateral neck portals The physical factors were 200 kv , 0 5 mm or 2 0 mm copper filter, 20 ma , 50 cm target-skin distance, 10 × 15 cm portal, with an occasional 8 × 10 cm portal, half-value layer of 0 9 or 1 8 mm copper, dosage rate from 10 r/min to 40 r/min , the most common being 30 r/min

1 *Standard Treatment Technic* The standard technic consisted in the administration of a daily skin dose of 400 r (with back-scatter), given either in the form of 200 r to the right and to the left sides of the neck each day, or 400 r daily to one alternate neck portal This provided an approximate *average daily tumor dose of 275 r* The beams of radiation were aimed so as to cross-fire the tumor Treatments were given five or six days a week The total tumor dose averaged approximately 6,000 r to 6,500 r in twenty-three to twenty-eight days Twenty-four patients were thus treated

A typical case is illustrated in Figure 1 The patient had a carcinoma of the

tonsillar pillar He was treated through two lateral neck portals, 8 × 10 cm each, and received a daily skin dose of 390 r (measured with scattering) to one alternate portal A total skin dose of 3,900 r was delivered to each of the two portals This was delivered in twenty treatments over a period of twenty-five days There resulted a third-degree reaction or epithelitis (thin curved line) in the mucosa, that healed by the forty-ninth day, and a second-degree reaction or epidermitis in the skin (heavy curved line), that healed by the fortieth day In order to destroy a radiosensitive squamous-cell carcinoma of the upper respiratory tract, it is usually necessary to produce at least a second-degree epithelitis and epidermitis These reactions of the skin and mucosa are an indication of the amount of destruction produced by radiation and serve as a guide in the treatment of a patient Since many biopsy specimens of irradiated tissue contain normal epithelium as well as tumor cells, the changes in these can be compared

The broken line in Figure 1 represents the shrinkage of the tumor This curve is based on clinical observations and, though subject to errors in interpretation, has prognostic value The radiosensitivity and radiocurability of a tumor are proportional to its rate of shrinkage For example, if the tumor has shrunk approximately 50 per cent in size by the sixteenth to the eighteenth day, there is a strong likelihood that it will be completely destroyed by the standard course of x-ray therapy If the rate of shrinkage is slower, roentgen therapy will have to be supplemented with other forms of treatment

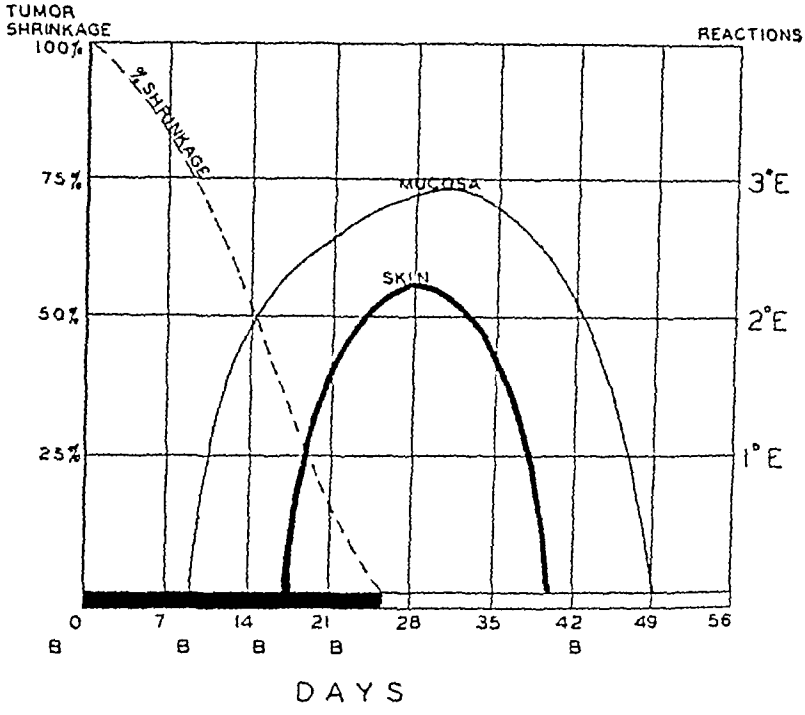

Fig 1 Graph illustrating tumor shrinkage and reactions of skin and mucosa in a typical case of carcinoma of the tonsil receiving standard irradiation. The factors were 200 kv , 20 ma , 50 cm distance, 8 × 10 cm portal, 0 5 mm copper and 1 mm aluminum filter, h v l 1 0 mm Cu, dosage rate 30 r/m The daily skin dose was 390 r (measured with scattering) to one alternate lateral face portal, total dose, 3,900 r to each of two lateral face portals, approximate average daily tumor dose, 275 r, total tumor dose, 5,500 r in twenty three days

There was a mild second-degree epidermitis, and a severe second-degree epithelitis (in the region where biopsies were taken) The tumor was radiosensitive and disappeared completely on the twenty-seventh day B (at bottom of graph) indicates day of biopsy

2 *One-half Standard Treatment Technic* (Fig 2) The "one-half standard treatment technic" consisted in the administration of a total daily skin dose of one-half of the standard amount, namely 200 r (measured with scattering) This was either given in the form of 100 r to the right and left side of the neck each day, or 200 r daily to alternate portals The average daily tumor dose was approximately 135 r In order to achieve the same total dose as with the standard technic, the daily treatments were extended over approximately twice the length of time One patient was treated for fifty six days (Fig 2) The others were irradiated over a period of fifty-one, sixty-seven, and one hundred and four days, respectively

The "one-half standard technic" was an experimental technic, using an inadequate daily dose for the purpose of eliciting and clarifying certain recovery responses following irradiation It was used in 4 cases Figure 2 illustrates the reaction curves of a typical case The patient had a carcinoma of the tonsil with metastases in the regional lymph nodes Treatment was given through two lateral neck portals measuring 10 × 15 cm , the daily dose being 100 r (measured with scattering) to each portal, for a total daily dose of 200 r The total skin dose was 4,080 r to each of the two portals This was delivered in 40 treatments over a period of fifty-six days

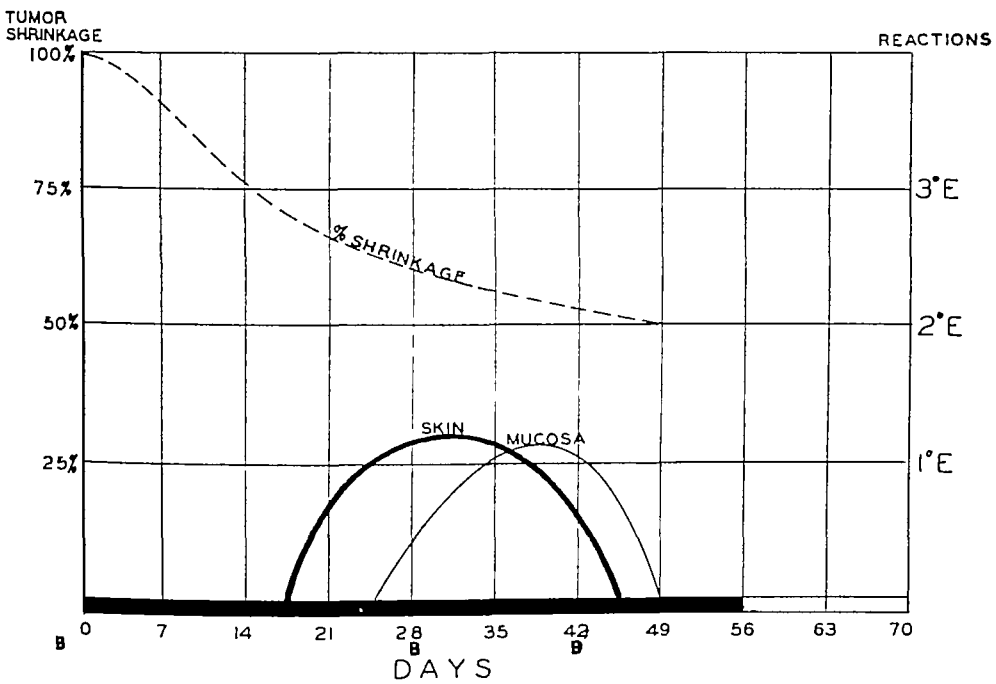

Fig 2 Graph illustrating tumor shrinkage and reactions of skin and mucosa of a radioresistant, under irradiated tumor, receiving one half the standard daily dose The daily tumor dose was 135 r and the total tumor dose was 5,400 r in fifty five days Reactions of skin and mucosa healed during treatment due to active recovery processes during the healing phase The tumor shrank 50 per cent and recurred several months later B (at bottom of graph) indicates day of biopsy See Figure 14

The administration of each daily destructive dose of radiation evokes a companion recovery effect Successive doses of radiation become cumulative in their effect It has been shown (5) that recovery effects are also cumulative A large daily dose of radiation depresses recovery processes and permits only a small recovery effect As can be seen in Figure 2, the small total daily dose of 200 r has permitted a strong recovery effect, resulting in a tardy onset and mild intensity of skin and mucosal reactions Furthermore, the strong recovery process

that attends inadequate daily irradiation is reflected in complete disappearance of the reactions while irradiation is being given, and only partial shrinkage of the tumor, which, under standard treatment, probably would have shrunken completely

This capacity to recover during the course of prolonged irradiation was observed not only in normal stratified squamous epithelium, but also in certain tumors If the destructive effect of irradiation on a tumor is sublethal, the tumor will again grow even during irradiation

TABLE II TIME DISTRIBUTION OF 140 BIOPSIE

Before irradiation	27
Weeks after beginning irradiation	
1/2	3
1	9
1 1/2	11
2	11
3	20
4	17
5	9
6	10
7	8
8	3
9	2
10	3
11	0
12	
13	
14	
20	
22	

Biopsy Material

The biopsy material (Table II) consisted of 140 specimens from 28 patients The number of biopsy specimens in each case varied from three to nine, with an average of five Each patient had a pre-treatment biopsy, with the exception of one whose earliest biopsy specimen was taken twenty-four hours after the first treatment In the beginning of the study, biopsy specimens were routinely taken at weekly intervals over a period of thirty-five to forty-two days It was soon observed that many important changes occurred during the first two weeks, and consequently additional specimens were taken in this period In a few cases biopsy specimens were obtained four, eight, twelve, and twenty-four hours after the first treatment After the twenty-eighth day, when the average course of treatment was concluded, the histologic changes occurred at a slower rate and the interval between biopsies was thereafter increased to two or more weeks For the purpose of studying late fibrosis, healing changes, and recurrences, biopsy specimens from 17 patients were taken between the fortieth and one hundred and fifty-first day

The usual criticism of a study of this type is that a particular biopsy specimen may not be representative of the histologic structure of the tumor Therefore, the number of pieces of tissue removed each time varied from one to four, with an average of two, from different areas of the tumor Each piece was larger than the usual biopsy specimen, varying from 5 X 6 mm to 9 X 12 mm, with an average of 6 X 8 mm When a tumor involved more than one anatomic structure (*i e*, tonsillar pillar and tongue), specimens were obtained from each area Whenever possible, an attempt was made to remove a portion of the adjacent normal epithelium for study During the first two weeks, when the tumor was bulky, a biopsy punch was used and numerous pieces of tissue were obtained from various areas After the fourteenth day, the tumor would become flat and fibrous, so that a wedge of tissue would be excised with a scalpel under novocain anesthesia Bleeding was usually readily controlled with pressure These multiple biopsy procedures did not seem to influence the rate of growth or spread of the tumor

Fixatives and Stains The majority of the biopsies were fixed in 10 per cent formalin, a few in Zenker's fluid Hematoxylin and eosin stains were routinely employed The following special stains were used alum hematoxylin to demonstrate keratohyalin, picro-nigrosin to demonstrate eleidin, and Mallory's phosphotungstic acid hematoxylin to demonstrate epithelial prickles and fibrils in the epidermis Connective tissue was studied with Masson's trichrome stain Von Kossa's silver nitrate method was used to demonstrate calcification of keratin and tumor cells

OBSERVATIONS

The histologic changes produced in tumor cells following irradiation of squamous-cell carcinoma are of the following major types

1 Acute cell death
2 Progressive enlargement to giant-sized tumor cells
3 Radiation keratogenesis

A tumor undergoing destruction by irradiation usually shows various combinations of the changes enumerated above, although one or even two of these changes may predominate in a single tumor Each type of change has special therapeutic and prognostic significance

Acute Cell Death

Acute cell death is the most common radiation effect observed in radiosensitive cells Its importance has been overlooked because cells undergoing this change rapidly disappear from the tissues and are not seen in later biopsy specimens Furthermore, the observer's attention is diverted by the bizarre changes occurring in the remaining cells

The process of acute cell death is chiefly lysis of the nucleus and cytoplasm Some pyknosis and karyorrhexis occur, but to a slight extent The cells undergoing acute cell death swell little, if at all The cell, including cell membrane, nucleus, cytoplasm and mitotic figures, rapidly disappears from view

Acute cell death occurs chiefly during the first week of irradiation In a radiosensitive tumor (Fig 3, A), acute cell death may commence twenty-four to forty eight hours after the first treatment and proceed so rapidly that, by the seventh day, 50 per cent or more of the tumor cells may have disappeared (Fig 3 B) Occasionally, a few less sensitive cells undergo acute cell death at a slightly slower rate and persist through the second week In this event, while lysis is still the dominant feature observed, karyorrhexis and pyknosis become more prominent (Fig 3, C)

Some radiosensitive cells are unaffected by irradiation for several weeks, or show only slight swelling and vacuolation When they finally succumb to radiation, they may degenerate in a manner similar to that seen in acute cell death Such cells, undergoing *delayed cell death*, are proportionately small in number (Fig 15, D) Occasionally a massive dose of radiation delivered to a radioresistant tumor may produce acute cell death

Following lysis and disappearance of tumor cells, there remain for a brief time adult connective-tissue fibers with wide interstices, formerly occupied by the tumor cells (Fig 15, B)

Giant-sized Tumor Cells

Another characteristic cell change produced by irradiation is the progressive and striking enlargement of the tumor cells, some of which attain a giant size In order to facilitate study of this process, we have arbitrarily designated as "giant-sized tumor cells" those whose diameter is greater than 60 microns Although these large cells were counted and used as an index, nevertheless similar changes of lesser degree occurred in smaller cells

As stated previously, the most radiosensitive cells usually undergo acute cell death The remaining, less radiosensitive cells undergo progressive enlargement and in some instances reach a giant size A small dose of radiation delivered to a radiosensitive tumor may cause a mild destructive effect resulting in progressive enlargement to giant-sized tumor cells

In the present study, the roentgen dose remained constant, but the varying susceptibility of the cell determined whether the mechanism of degeneration was to be acute cell death or the formation of giant-sized cells Melnick (1) used a tumor of constant radiosensitivity and varied the dose With a dose of 20 S E D (10,500 r), he obtained acute necrosis in two to three days, with 6 to 8 S E D (3675 r) necrosis occurred after a latent period of five days, however, with a small dose, 3 8 S E D (2000 r), there resulted mutation-like

Fig 3 Undifferentiated squamous-cell carcinoma of soft palate radiosensitive

[Legend continued on opposite page]

pleomorphism ending in complete degeneration in fourteen to sixteen days (giant-sized tumor cells)

Tumors showing pleomorphism (including large-sized cells) in the biopsy specimen taken before treatment have a greater tendency toward giant-sized tumor cell formation following irradiation than do tumors showing little or no pre-treatment pleomorphism Thus an inherent tendency of a tumor cell toward pleomorphism may be accentuated by irradiation

In the biopsy specimens studied, giant-sized tumor cells began to appear in the latter part of the first week They increased in number, becoming most numerous toward the end of the second week and the beginning of the third week of treatment, and usually disappeared completely near the end of the seventh week (see Fig 5, A, B, and C)

Whenever the tumor recurred, as it did in 5 cases in our series, it usually resembled the original tumor and was devoid of any giant-sized tumor cells This suggests that most giant-sized tumor cells are mutation forms incapable of survival or reproduction In two recurrent tumors there was a slight increase in pleomorphism, this might be attributed to a permanent non-lethal translocation of chromosomes with resultant viable mutants However, it is equally plausible that the increased pleomorphism resulted from alteration of the tumor bed, vascular supply, rate of growth, and other factors known to influence the appearance of tumor cells The material studied does not solve this question

There are two different types of giant-sized tumor cells those showing swelling and vacuolation (physical - chemical changes) and those showing nuclear aberrations (chromosome derangements)

Type 1 Swelling and Vacuolation Due to Physical-Chemical Changes Giant-sized tumor cells showing physical-chemical changes present such varied appearances as to warrant a description of each component part of the cell—cell membrane, nuclear membrane, and the nuclear material

The appearance of the cell membrane may be influenced in three ways It may be accentuated by marked vacuolation of the cytoplasm, by condensation of the adjacent cytoplasm, or by the formation of a perimeter of keratin in the cytoplasm As the cell progressively enlarges, the cell membrane finally ruptures and the cytoplasmic content streams out into the surrounding tissues (Fig 4, B)

Concerning the cytoplasmic alterations in giant-sized tumor cells, there are two types of change diffuse, expansile swelling of the cytoplasm and formation of degenerative vacuoles In diffuse expansile swelling, the cytoplasm increases in volume and stains palely, as though it had been diluted with fluid (Fig 5, B and C) This process usually becomes complicated by the simultaneous formation of vacuoles, although not infrequently a cell may reach giant size without having any vacuoles At the same time, the nucleus may enlarge in a similar fashion It is not unusual, however, to see marked cytoplasmic swelling with either a normal-sized or only a slightly enlarged nucleus

Failla (6) has offered an explanation of the mechanism of cytoplasmic swelling The permeability of the cell or nuclear membrane is altered, with consequent increased rate of osmosis During irradiation, there occurs an increased dispersion of electrolytic ions both in the cells and in the fluid of the surrounding spaces The extracellular ions are carried away by the tissue fluids, leaving a relatively increased concentration of ions within the cell In order to re-establish equilibrium, the cell absorbs fluids, thereby becoming markedly swollen

A Appearance before treatment $\times c$ 275
B Biopsy taken on 7th day Lysis of most of the tumor cells has occurred leaving cell spaces " The remaining cells reveal different stages of lysis $\times c$ 275
C Biopsy on 14th day A less radiosensitive area showing delayed acute cell death Lysis of tumor cells is less marked $\times c$.275

The formation of vacuoles probably occurs through a physical-chemical process similar to that of diffuse swelling The size and number of vacuoles vary considerably in different tumors and in different cells of the same tumor Vacuole formation is nevertheless a progressive process It starts either in a few cells with a few small vacuoles that increase in size and number, or else with minute vacuoles in the perinuclear region (Fig 5, B) There may be one or a few large clear vacuoles in the cytoplasm (Figure 4, B and 5, C), or a moderate number of similar-sized vacuoles evenly distributed throughout the entire cytoplasm Numerous vacuoles may almost completely replace the cytoplasmic material and compress the remnants into thin, axial strands that radiate from the nucleus to the cell membrane A single cell may show successive stages wherein small vacuoles coalesce to form large vacuoles of various sizes

The appearance of some cells suggests that diffuse swelling and vacuolation are different stages of a single process Of the physical-chemical changes, vacuolation is the most frequent In a few of the tumors, however, diffuse swelling of the cytoplasm is the dominant process

Vacuolation also occurs in the nucleus, but at a later date and to a lesser extent than in the cytoplasm On occasion, vacuolation may be marked in the cytoplasm but absent in the nucleus Under these circumstances, there is usually some other type of alteration present in the nucleus as described below

Type 2 Nuclear Aberrations Due to Chromosome Derangements Irradiation produces a greater variety of degenerative forms in the nucleus than in the cytoplasm In those tumors that exhibit pronounced nuclear alterations as a result of irradiation, biopsy specimens taken between the seventh and twenty-first days will show progressive stages in the development of abnormal nuclear forms

Frequently when the "before" specimen shows variation in size and shape of the nucleus, and hyperchromatism, these nuclear alterations are likely to be accelerated and intensified by subsequent irradiation (Fig 5) It is not uncommon, in islands of tumor cells having a central core of keratinized cells and a peripheral band of prekeratinized polyhedral cells to find that during the course of irradiation the central core will undergo progressive keratogenesis, whereas the peripheral cells will undergo progressive nuclear alterations

In the nucleus undergoing hyperchromatism, the following more or less progressive changes are observed (Fig 5) an increase in the number of small chromatin granules, large masses of chromatin irregularly distributed throughout the nucleus, swollen nucleoli, taking a deep esosinophilic stain, varying degrees of condensation of the chromatin so that finally there results a large hyperchromatic nucleus of variable shape, vacuolation of the large hyperchromatic nuclei, the vacuoles varying considerably in size and number Eventually, in the third and fourth weeks, there are karyorrhexis and karyolysis of the large hyperchromatic nuclei

In the enlarging nuclei that are becoming hypochromatic, the following more or less progressive changes are to be observed focal condensation of chromatin material into small granules resulting in vesiculated nuclei, transformation of chromatin into globules of palely staining material, vacuolation of the large hyperchromatic nuclei, chromatin evenly distributed throughout the nucleus in the form of palely staining fine powdery granules, and finally various degrees and stages of karyolysis In the later stages, after the third week, there may be seen an occasional isolated large, pale nuclear shadow in the connective-tissue stroma This may represent late karyolysis of a disrupted hypochromatic or a previously hyperchromatic nucleus

The above descriptions apply to giant sized tumor cells However, in cells that enlarge slightly, the changes observed are the same except that they are generally milder in degree and represent an earlier stage of degeneration These cells may be

Fig 4 Undifferentiated squamous-cell carcinoma of soft palate, moderately radiosensitive

A Appearance before treatment ×500

B Biopsy on 21st day of treatment Giant sized tumor cell formation due predominantly to swelling and vacuolation of the cytoplasm Cell in lower right hand corner reveals perinuclear fine vacuolation of the cytoplasm around the periphery is a zone of early keratinization Elsewhere are seen various stages of cytoplasmic swelling and vacuolation, with one cell bursting and its contents streaming into the tissue ×500

Fig 5 Undifferentiated squamous-cell carcinoma of floor of mouth

[Legend continued on opposite page]

present in the same specimen together with giant-sized tumor cells (Fig 5) Occasionally, these smaller cells may show advanced degenerative changes such as karyolysis This is the type of change more often seen in acute and delayed cell death

In a radioresistant tumor, the degenerative changes may be slight in degree, delayed in time of appearance, or absent

Mitotic Figures Mitotic figures were studied by counting separately the normal and abnormal figures in fifteen representative high-power fields in each biopsy specimen Three average counts were obtained for each specimen one for normal mitotic figures, one for abnormal, and one for the total number of mitotic figures These were plotted in a graph (Fig 6) In the group of abnormal mitotic figures there were included only those bizarre forms produced by radiation injury The atypical mitotic figures commonly found in untreated tumors were considered to be normal for the tumor and were therefore grouped with the normal mitotic figures

Examination of Figure 6 indicates that the number of normal mitotic figures, averaging 1 6 per high-power field, drops precipitously during the first fourteen days By the end of this period, normal mitotic figures have almost completely disappeared, except in an occasional radioresistant tumor that may contain a few normal mitotic figures as late as seven weeks after the first treatment In contrast, abnormal mitotic figures, that were rare in the unirradiated specimen, increased in number rapidly during the first week During the second week they decreased in number so that by the fourteenth day few were present In some radioresistant tumors, a few abnormal mitotic figures were observed as late as six weeks after the beginning of treatment

There is a probable relationship between radiation-induced abnormal mitoses and giant-sized tumor cells due to nuclear aberrations The latter are the end-result of the process of cell division disturbed by irradiation In Figure 7, the average incidence of abnormal mitotic figures is compared with that of giant-sized tumor cells As stated above, abnormal mitotic figures increase moderately in number during the first week, reaching a peak on the seventh day, and decreasing thereafter Giant-sized tumor cells are first seen in significant numbers on the fourth day, they increase rapidly, reaching a peak on the thirteenth day, and then decrease in number at a slower rate In an occasional radioresistant tumor, giant-sized tumor cells are found in conjunction with abnormal mitoses during the fifth to the eighth week

The above observations suggest that as a result of irradiation there is a pattern of progression from normal mitotic figures to abnormal mitotic figures to giant-sized tumor cells to profound nuclear disturbances In radiosensitive tumors, these events occur during the first few weeks, in radioresistant tumors they take place at a later time and are milder in degree

Some authors have considered these giant-sized cells to be mutation forms resulting from radiation-induced chromosome alterations According to genetic laws, some of these abnormal forms should perpetuate themselves in persistent radioresistant tumors or in recurrences However, the progressive disappearance, for the most part in a few weeks, of these giant-sized tumor cells would seem to indicate that they are degenerative, dying mutation forms It is well known that

A Appearance before treatment Note tendency toward multinucleation In the multinuclear cells the nuclei are similar in appearance to those of the mononuclear cells ×*c* 300

B Biopsy on 7th day Early radiation changes in the form of enlargement and distortion of the nuclei Many cells are enlarged, due to cytoplasmic swelling, and are causing compression and pyknosis of a few cells ×*c* 300

C Biopsy on 14th day Striking example of giant sized tumor cells due to cytoplasmic changes as well as nuclear aberrations In the cytoplasm can be seen changes progressing from swelling to minute vacuolation to large vacuoles ×*c* 300

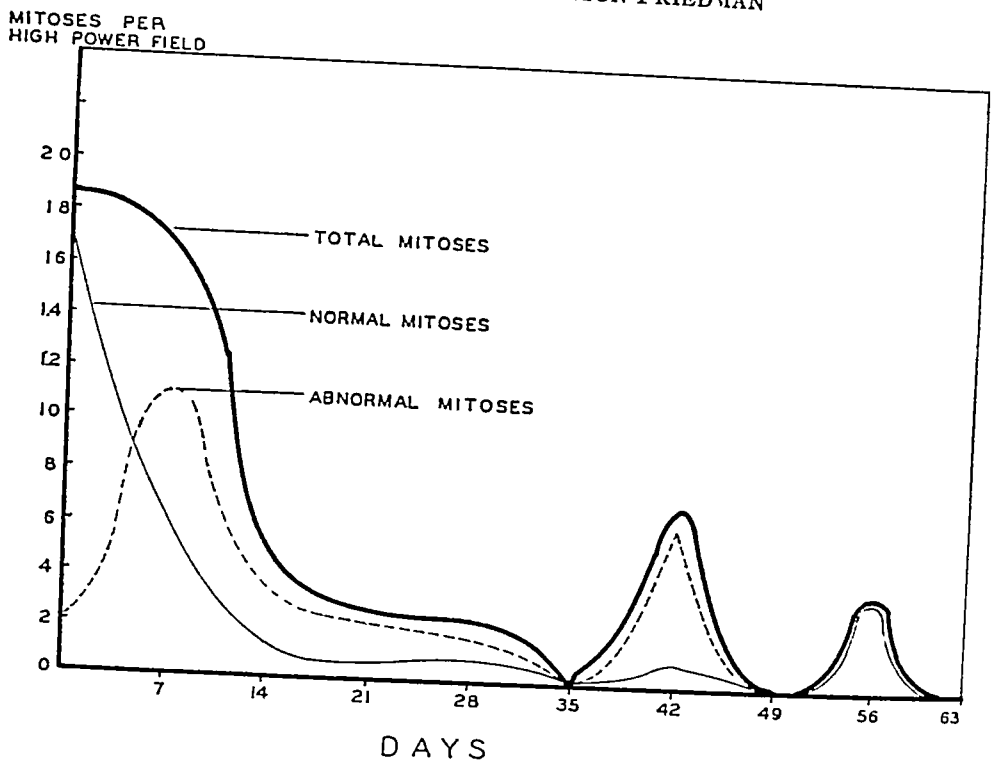

Fig 6 Study of normal and abnormal (radiation-induced) mitotic figures Points on curve represent average of all cases in this series During the first two weeks, as the normal tumor mitoses decrease, the abnormal radiation-induced mitoses increase Two radioresistant lesions raised the average in the 6th and 8th weeks

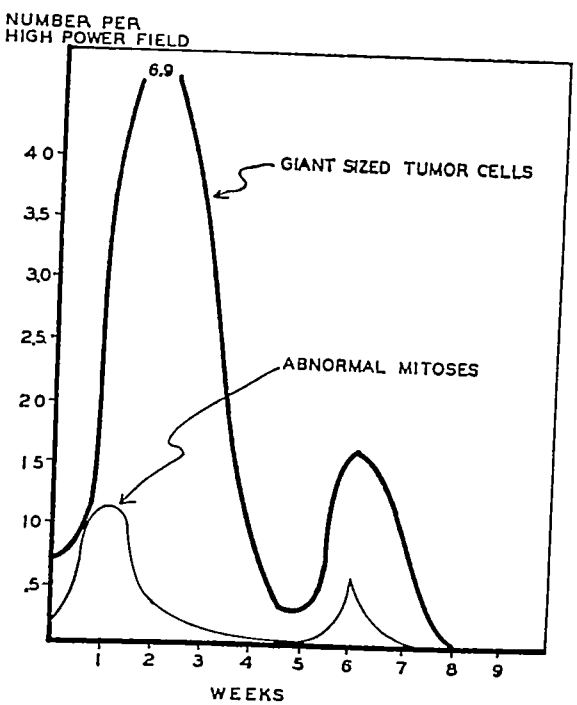

Fig 7 Relationship between time of appearance of radiation-induced abnormal mitotic figures and giant-sized tumor cells (mutation forms) Points on curves represent average of all cases in this series Reduction in number of abnormal mitotic figures is succeeded by a marked increase in number of giant-sized tumor cells

certain recurrent tumors may differ slightly in appearance from the primary tumor There is no evidence to show whether these differences are the result of mutation changes or of other environmental influences such as changes in the tumor bed

Cells containing radiation-induced abnormal mitotic figures either undergo destruction or complete the process of cell division with the formation of abnormal, bizarre, daughter cells that are incapable of perpetuation These bizarre cells exhibit the following distortions lobate nuclei, multinucleation, and giant-sized frequently hyperchromatic, nuclei Lobated nuclei are probably the end-product of radiation-induced abnormal mitotic figures (Fig 5, c)

Multinucleated Cells The appearance of multinucleated cells may have three possible explanations they may be explained by a mild form of damage to the nucleus directly, they may be the result of injury in an early phase of mitosis, or they may represent an accentuation of the pre-

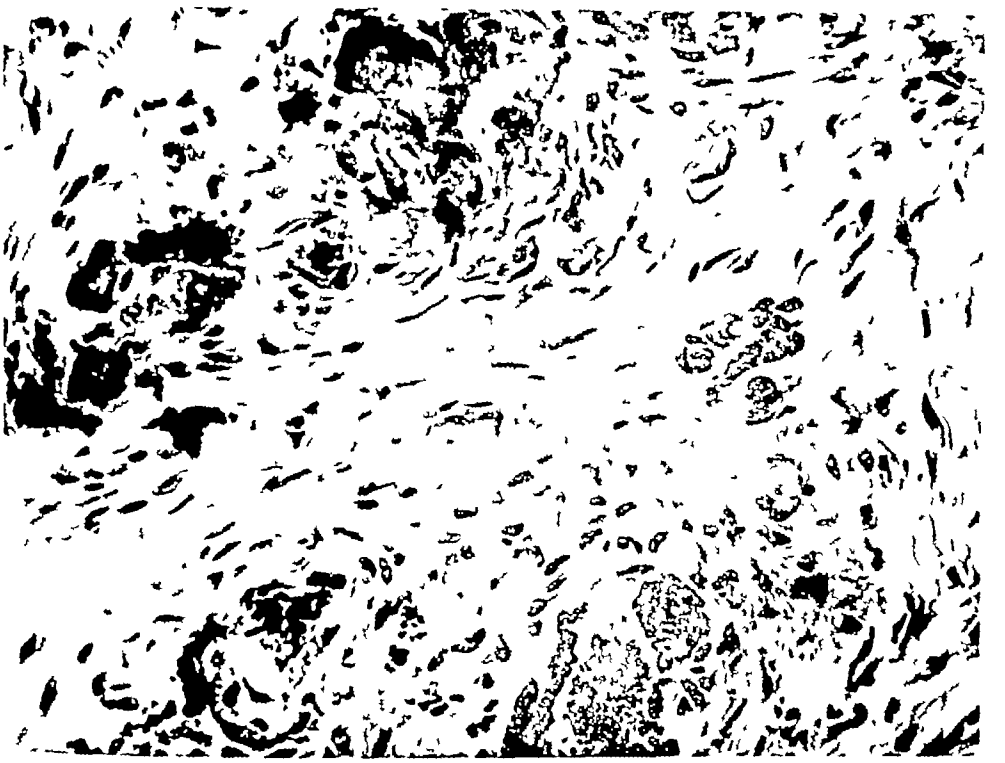

FIG 8 Biopsy on 24th day, showing areas of calcification in the stroma ×375

existing tendency of a tumor to form multinucleated cells (Fig 5) Concerning the latter, it is observed that radiation-induced multinucleated cells are most commonly seen in anaplastic tumors having multinucleated cells before irradiation Following irradiation, the number of nuclei per cell and the number of multinucleated cells are increased These nuclei are often normal in appearance, and show fewer radiation changes than are seen in a mononuclear tumor cell, suggesting that the destructive effect is expended against the process of cell division rather than the cell itself

Calcification

Although some authors describe calcification of tumor cells as a common radiation effect, it was not prominent in our material

Melnick (1) irradiated the Flexner-Jobling rat carcinoma and the Jensen rat sarcoma and in some of the tumors found "surviving tumor cells all transformed, under various forms of fractional doses, into a pure growth of abnormal, hyperchromatic giant cells These abnormal cells degenerated in a specific manner by calcification of the nucleus" Melnick and Halley (2), in studying human breast carcinomas that were irradiated preoperatively, found that after the most sensitive cells were destroyed, the remaining cells underwent mutation to an abnormal giant-sized cell that degenerated not by necrosis but by calcification of the nucleus On the other hand, Warren *et al* (7) and Schmitz and his associates (8), in studying the effect of irradiation on squamous-cell carcinoma of the uterine cervix, did not mention calcification as one of the changes

Calcification was not found in our material as a significant change Small amounts of calcium were seen in one tumor in the center of a few keratin masses on the fourteenth day, in another a few small masses of calcium were present in the dense connective-tissue stroma on the twenty-fourth day (Fig 8) It could not be determined whether this represented

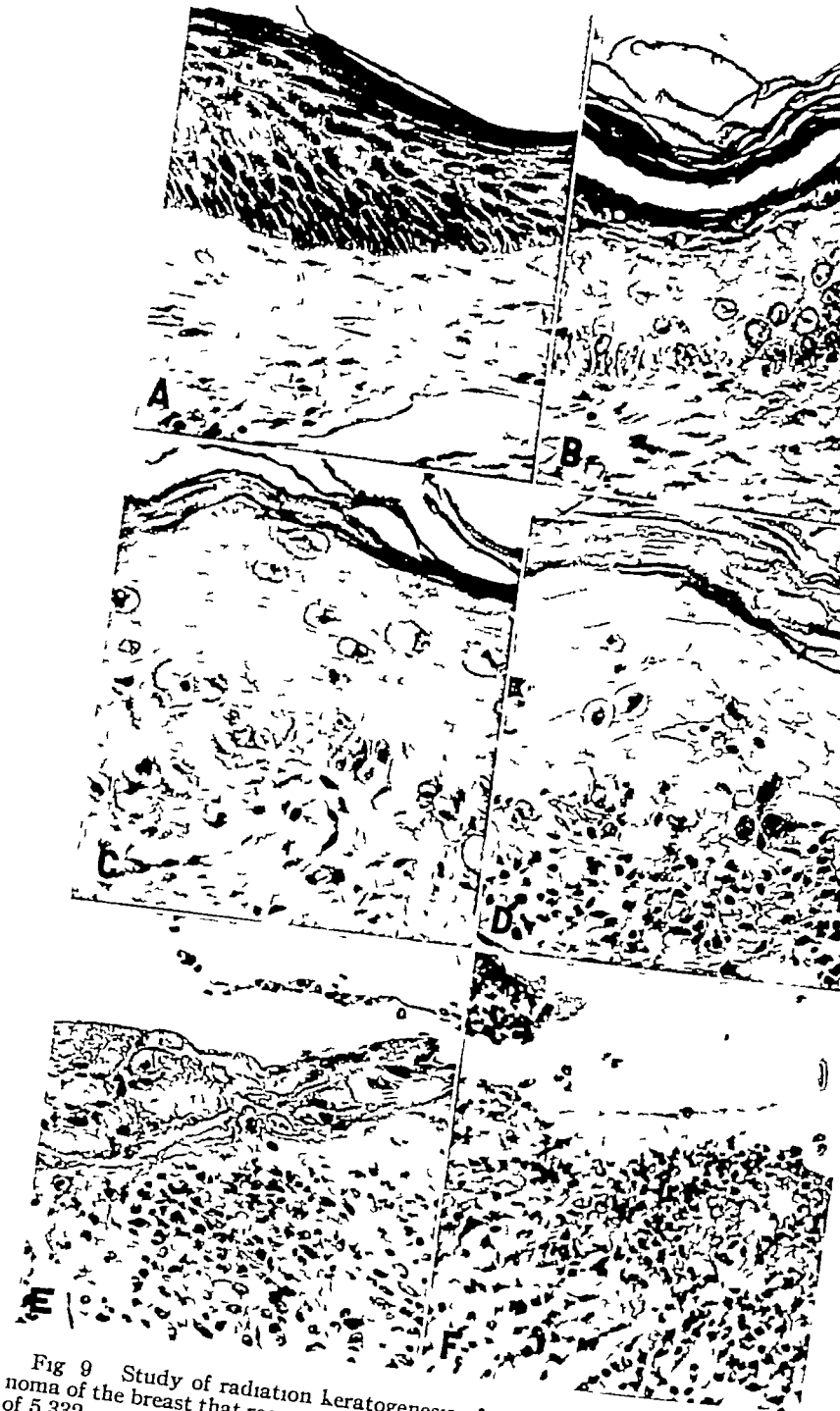

Fig 9 Study of radiation keratogenesis of normal skin overlying a carcinoma of the breast that received a daily skin dose of 266 r and a total skin dose of 5 332 r in 24 days

A Normal skin before irradiation ×225

B Biopsy on 12th day Skin dose 2 926 r Increased keratinization with slight increase in thickness of the epidermis ×225

C Biopsy on 19th day Skin dose 4,522 r Progressive keratinization and swelling of cells with increased thickness of epidermis Basal cells are becoming keratinized ×225

D Biopsy on 23rd day Skin dose 5 106 r Progressive swelling and keratinization Disruption of the basal layer and inflammatory cell response in the underlying corium are preliminary to total desquamation of the epidermis ×225

E Biopsy on 23rd day Another area reveals separation of keratinized epidermis and partial desquamation ×225

F Biopsy on 38th day, fourteen days after a total skin dose of 5 332 r Complete desquamation of epidermis with fibrino-cellular reaction ×225

calcification of tumor cells or of keratin masses

Radiation Keratogenesis

The third method whereby normal squamous epithelium and squamous-cell carcinoma are destroyed by irradiation is through the process of *radiation keratogenesis* This process occurs less often than acute cell death or giant-sized tumor cell formation, and is probably the least important mechanism of radiation injury

Radiation keratogenesis is the acceleration either in rate or degree of the normal process of keratinization It is a cytoplasmic phenomenon, although the process might be activated by the effect of radiation on the nucleus Those nuclear changes observed in association with radiation keratogenesis are either secondary to keratinization of the cytoplasm or are the result of the direct action of radiation on the nucleus, as described previously The actual time required for the basal cell of normal stratified squamous epithelium to differentiate and keratinize is not definitely known It probably varies in different regions of the body

Radiation Keratogenesis of Normal Skin Irradiation of normal skin will accelerate the process of keratinization Keratinization progressively involves the deeper layers of irradiated epithelium so that prickle cells and finally basal cells become keratinized When the latter become fully keratinized, the epidermis begins to separate from the corium and finally desquamates

The process of radiation keratogenesis is illustrated in Figure 9, A to F On the twelfth day after the first treatment (Fig 9, B), there is an increase of the thickness of the entire epidermis The stratum corneum is moderately increased in thickness due to the accumulation of additional layers of keratinized cells from the underlying strata The cells of the prickle-cell layer are slightly swollen and their intercellular bridges are less prominent These swollen prickle cells also show early diffuse keratinization The nuclei of the cells of all the layers are swollen, with a loss of peripheral chromatin material On the nineteenth day (Fig 9, C), there is a marked increase in thickness of the epidermis, due chiefly to swelling of cells, though there is an actual decrease of the number of layers of cells as a result of desquamation of some hornified cells All cells below the stratum corneum are swollen and show progressive degeneration, with the formation of large vacuoles Keratinization is now present in all layers, including some of the basal cells The well demarcated thickened stratum corneum is manifested clinically at this stage by a brownish discoloration, and the superficial layer of the skin can be partly peeled off in fine flakes This should not be confused with the late deposition of pigment in the corium following the subsidence of a first-degree erythema On the twenty-third day, at the height of the skin reaction, there is further swelling of the cells, combined with diffuse keratinization of the cytoplasm (Fig 9, D), the cytoplasmic material of contiguous cells commences to fuse, the nuclei have undergone further degenerative changes, with disappearance of some of them, the basal layer presents similar changes and has become almost unrecognizable as a separate layer At the same time (Fig 9, E), other areas may be completely keratinized, with early separation of the keratinized basal cells from the underlying corium By the thirty-eighth day (Fig 9, F), there are complete desquamation of the keratinized epidermis and replacement with a pseudodiphtheritic membrane

Radiation Keratogenesis of Normal Mucosa Early during the course of fractionated irradiation, there appears on the irradiated oral mucosa a membrane-like white layer over the hard palate (Fig 10), buccal mucosa, gums, and tongue The white layer becomes progressively denser and eventually represents an area of radiation-induced leukoplakia It is uniform and smooth Its thickness may depend on many factors individual susceptibility, tissue susceptibility, amount of irradiation,

Fig 10 Radiation induced leukoplakia of normal hard palate and edentulous alveolar ridge Note absence of this phenomenon in the non keratinizing epithelium of the retromolar fossa

and distribution in time of the radiation dose

The regions where radiation-induced leukoplakia develops correspond to the regions that Coutard said were covered with a keratinizing type of epithelium from which radioresistant tumors are prone to develop These areas are the hard palate, gums, buccal mucosa, and dorsum of the tongue This membrane appears on the twelfth to the eighteenth day after the first treatment and becomes progressively more intense

In other areas exposed to similar amounts of radiation, as the faucial arch (uvula, soft palate, anterior tonsillar pillars), floor of the mouth, under-surface of the tongue, retromolar area (Fig 10), oropharynx, and hypopharynx, radiation leukoplakia does not develop These areas are covered with a so-called non-keratinizing type of mucosa, and in general give rise to more radiosensitive carcinomas

The more radiosensitive the tissue, the earlier will it respond to irradiation For example, the average time of appearance of the second-degree epithelitis with denudation of the mucosa is the fourteenth day Keratinizing epithelium, though receiving the same dose of radiation as the non-keratinizing epithelium, will behave like radioresistant skin (Fig 1), in that reactions will begin later and generally be milder in degree Thus, on the fourteenth day, when the non-keratinizing mucosa is becoming denuded, the radiation leukoplakia in the keratinizing mucosa is just commencing When the mucosal epithelitis approaches a third-degree intensity, on or about the twenty-fifth day (Fig 1), the keratinizing mucosa or the skin may still show only mild or moderate keratogenesis with thickening of the stratum corneum, as in Figure 9, C

Radiation keratogenesis of mucous membrane and anal skin is observed clinically as a white membrane In the skin of the remaining portions of the body, it appears as a brownish, superficial, parchment-like membrane, due to the thickened stratum corneum

Radiation Keratogenesis of Tumor Cells Tumor cells of a squamous-cell carcinoma may undergo radiation destruction through the process of radiation keratogenesis This effect is similar to that observed in stratified squamous epithelium of normal skin and mucosa Keratinization of the cytoplasm in the tumor cell proceeds to completion, the nucleus becomes compressed and pyknotic, and the cell becomes mummified and is desquamated

Although a few writers have observed increased keratinization following irradiation, the role of radiation keratogenesis as a mechanism of cell destruction has not been stressed In an occasional tumor, radiation keratogenesis may be the dominant mechanism of cell destruction However, the process is seen in varying degrees in most irradiated squamous-cell carcinomas Its rate and amount depend on three factors inherent tendency of the tumor cell to keratinize, radiosensitivity of the tumor cell, and size of the daily radiation dose

Occasionally radiation keratogenesis occurs very early during treatment This process is well illustrated in Figure 11, showing a moderately well differentiated squamous-cell carcinoma of the floor of the mouth, with central keratinization involving approximately 15 per cent of the cells (Fig 11, A) Forty-eight hours

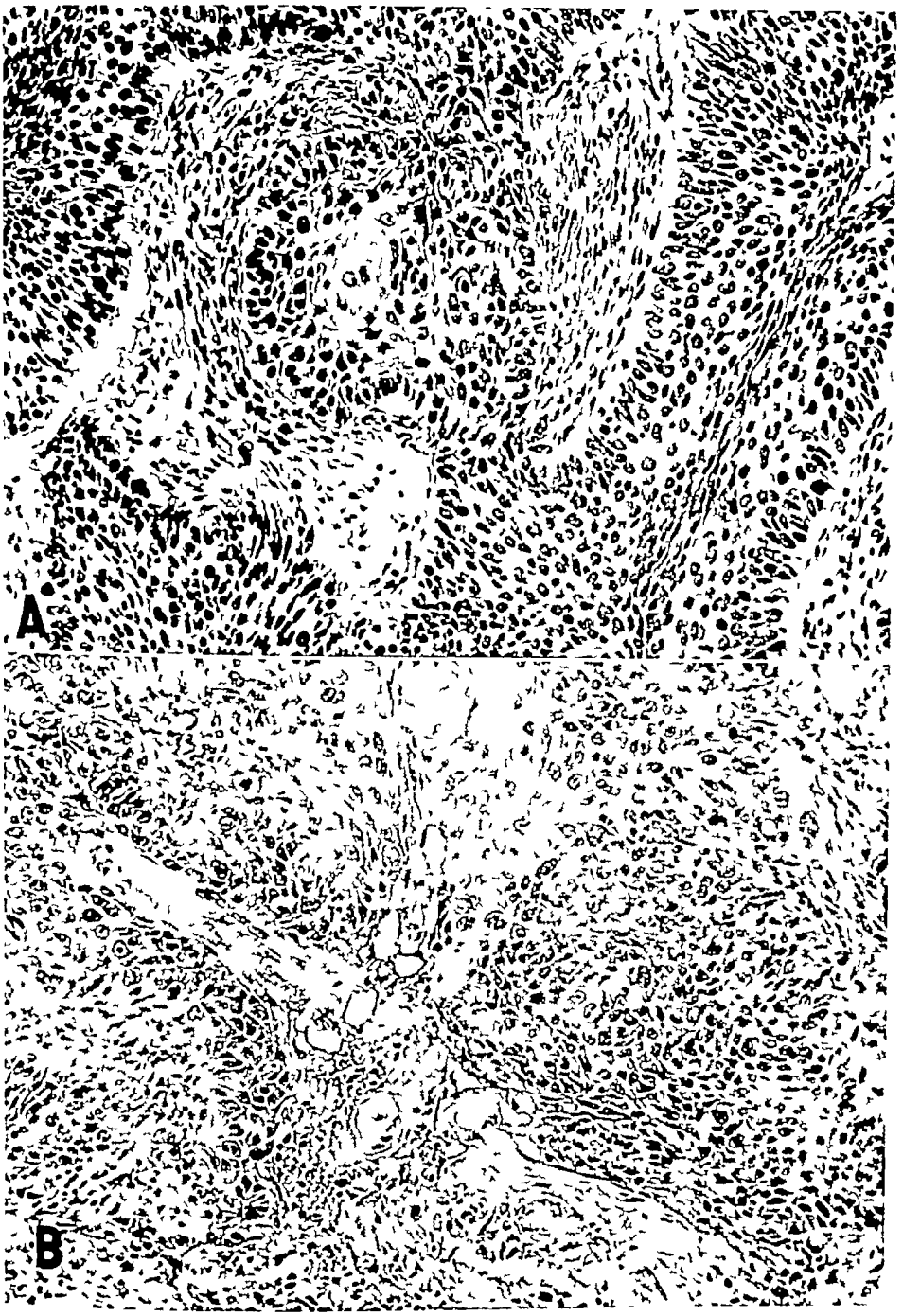

FIG 11, A and B Squamous-cell carcinoma, with moderate differentiation, destroyed almost exclusively by the process of radiation keratogenesis

A Biopsy before treatment Approximately 15 per cent of the cells are keratinizing ×c 180

B Biopsy 48 hours after first treatment Marked increase of keratinization At this time approximately 50 per cent of the cells are keratinizing ×c 180 See also Figure 11, C and D

after the first treatment, there is a marked increase of keratinization, that now involves approximately 50 per cent of the cells (Fig 11, B) In areas where keratinization is most marked, many additional cells of the prickle-cell layer have become

keratinized Some of the completely keratinized areas contain solid keratin masses In the other areas, many of the cell layers escape keratinization In association with and probably secondary to irregular keratinization, there is some loss of stratification

On the ninth day, the process of keratinization has involved almost all the tumor cells The tumor has shrunken approximately 25 per cent in volume and has lost approximately 35 per cent of the cells histologically However, the percentage of keratinized tumor cells has increased from 15 to 95 per cent, and most of these remaining cells are non-viable (Fig 11, C) Only the peripheral layer of basal cells circumscribing some islands of tumor cells is non-keratinized The remaining cells show all gradations of keratinization As the process progresses, the nucleus is compressed, reduced in size, and finally disappears The cell is now completely keratinized and mummified

These cells may be desquamated from the surface of the tumor or, if deeply located, may remain in the tumor bed as solid keratin masses (Fig 11, D) Later, multinucleated foreign-body giant cells surround the keratin masses for the purpose of phagocytosis In all probability, this is the only reason for the presence of multinucleated foreign-body giant cells in irradiated squamous epithelium

In 8 of the 24 tumors of this series treated with an effective daily tumor dose of radiation (approximately 275 r), there was a significant increase of radiation keratogenesis In 4 of these 8, radiation keratogenesis played the dominant role in the destruction of the tumor In the remaining 4, this process played a minor role in tumor destruction

Radiation keratogenesis was most prominent in tumors with slight to moderate keratinization and classified as grade 2 This again confirms the principle that the characteristic histologic features of a tumor are often intensified and accelerated by irradiation The unexpected radiosensitivity of an occasional grade 2 squamous-cell carcinoma may be due to destruction through the process of radiation keratogenesis This may explain some errors in the histologic estimation of the radiosensitivity of a tumor

All 4 cases that were purposely underirradiated, with one-half of the usual daily tumor dose (135 r), showed increased though mild radiation keratogenesis The process in these instances was one of maturation of keratinizing cells rather than complete destruction of the tumor cells (Fig 14)

In 11 of the 28 cases, multinucleated foreign-body giant cells were found in close apposition to keratin masses that they were phagocytizing There was considerable variation in the time of appearance of these giant cells They were first noted on the fourteenth day after onset of treatment, were present during the third and fourth weeks, and occasionally as late as the seventh week

Spontaneous Desquamative Keratinization Occasionally, an untreated tumor cell, in the course of normal maturation, will rapidly change from a pre-keratinizing polyhedral cell to a completely keratinized cell that is promptly desquamated into the stroma and becomes surrounded by foreign-body giant cells This was seen in the "before-treatment" biopsies of two tumors In one of these cases (Fig 13), radiation keratogenesis played a dominant role in the destruction of the tumor, which was radiosensitive, in the other (Figs 1 and 12), the tumor was extremely radiosensitive, and the second biopsy, taken on the tenth day, showed only 5 per cent of the tumor cells remaining, and more than half of these were keratinized Although acute cell death played an important role in the destruction of the large transitional-cell component of the tumor, radiation keratogenesis also contributed to the destruction of cells

These two cases suggest that a tumor having spontaneous desquamative keratogenesis before treatment is likely to reveal accelerated radiation keratogenesis Spontaneous keratogenesis in the original biopsy specimen, therefore, may be an index of

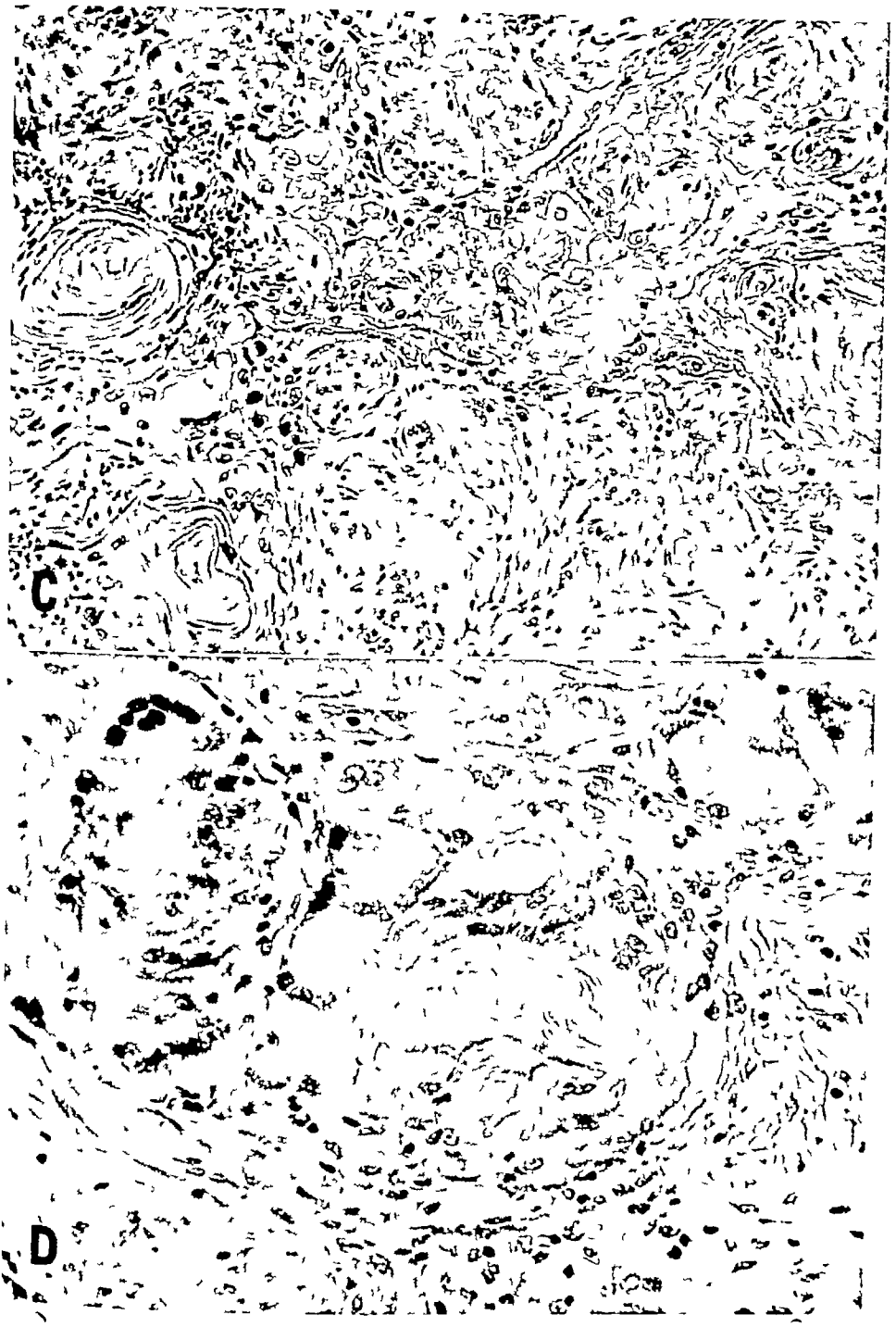

FIG 11 C and D Same tumor as shown in FIGURE 11, A and B
C Biopsy on 9th day Practically all residual tumor cells are keratinizing or keratinized X*c* 180
D Biopsy on 35th day Tissue removed from the tumor at this time reveals only masses of keratin surrounded by multinucleated foreign-body giant cells

radiosensitivity This observation provides additional evidence that a physiologically active cell—in this instance, active keratin production in the cytoplasm—may be as radiosensitive as reproductively active cells with numerous mitoses

Maturation of a Tumor Due to Under-Irradiation

In previous clinical studies of skin reaction and tumor shrinkage rates (4, 5), it was observed that, when a small daily dose of roentgen rays was administered over an extended period of time, a peculiar phenomenon occurred (Fig 2) At the beginning of the fifth week of treatment, skin and mucosal reactions began to heal in spite of continued irradiation Apparently, normal stratified squamous epithelium is able to protect itself by means of a recovery process and to acquire the ability to withstand radiation bombardment The exact mechanism is unknown, although a number of factors participate

The study of tumors treated with one-half the optimum effective daily tumor dose (*i e*, 135 r) indicated that a tumor, when under-irradiated, might also adapt itself to the destructive effect of radiation During this recovery phase the tumor may become more mature histologically

This process of maturation is illustrated in Figure 14 The original tumor (Fig 14, A) was an undifferentiated carcinoma of the tonsil The tumor was purposely under-irradiated, with a daily tumor dose of 135 r On the twenty-first day (Fig 14, B) there was slight destruction of the tumor, but the remaining cells were grouped in islands and had begun to show early stratification, central keratinization, and a few intercellular bridges A few of the remaining cells had been injured by the radiation as indicated by the formation of giant-sized tumor cells The stroma had become more adult in type On the forty-second day—at which time the skin and mucosal reactions had healed in spite of continued daily irradiation—the maturation of the tumor had become marked (Fig 14, C) There was no further tumor destruction, but increased stratification and more advanced keratinization How much of the latter represented maturation and how much represented radiation keratogenesis could not be determined At this time, the tumor had shrunken 50 per cent in volume Many of the cells were viable, as the tumor resumed active growth shortly thereafter This is a typical example of the true maturation of a tumor that has received an inadequate daily dose of radiation

There is an optimum daily dose and an optimum time period in an efficient course of irradiation of a tumor The common practice of avoiding severe local and general x-ray reactions by reducing the daily dose and extending the treatment over an unusually long period of time, such as two months, is inefficient During the second month of treatment, recovery phenomena dominate radiation reactions The tumor may mature and thereby acquire increased radioresistance It is probable that increased maturity of the tumor and decreased vascularity of the stroma further contribute to radioresistance

Occasionally, during the recovery phase (twenty-eighth to forty-second day) of an under-irradiated tumor, regrowth may be observed during irradiation without histologic maturation of the neoplasm

The above statements refer to squamous-cell carcinoma For other tumors there are probably specific values for optimum daily dosage and total period of irradiation

Changes in Stroma

The effect of irradiation on the stroma of a tumor has been the subject of considerable investigation and discussion The term stroma is applied to the connective-tissue framework and blood vessels supporting and nourishing the tumor cells, whereas the term "tumor bed" is applied to surrounding normal tissues in which the tumor is located The following discussion is confined to stromal changes

The changes to be described are those seen in the connective-tissue stroma intimately related to the tumor cells From our observations, stromal changes appear to be reactive phenomena secondary to the destruction of the tumor cells These changes are replacement fibrosis, maturation of connective-tissue fibers and, to a

Fig 12 Spontaneous keratogenesis in a tumor Moderately undifferentiated squamous-cell carcinoma of the tonsillar pillar before irradiation Desquamation of completely parakeratinized cells into tumor interstices in upper right corner of photograph Xc 145

Fig 13 Spontaneous keratogenesis in a tumor Squamous-cell carcinoma with varying degrees of differentiation, before irradiation Desquamation of keratinized cells and keratin masses into the stroma with a foreign body giant cell reaction Xc 145

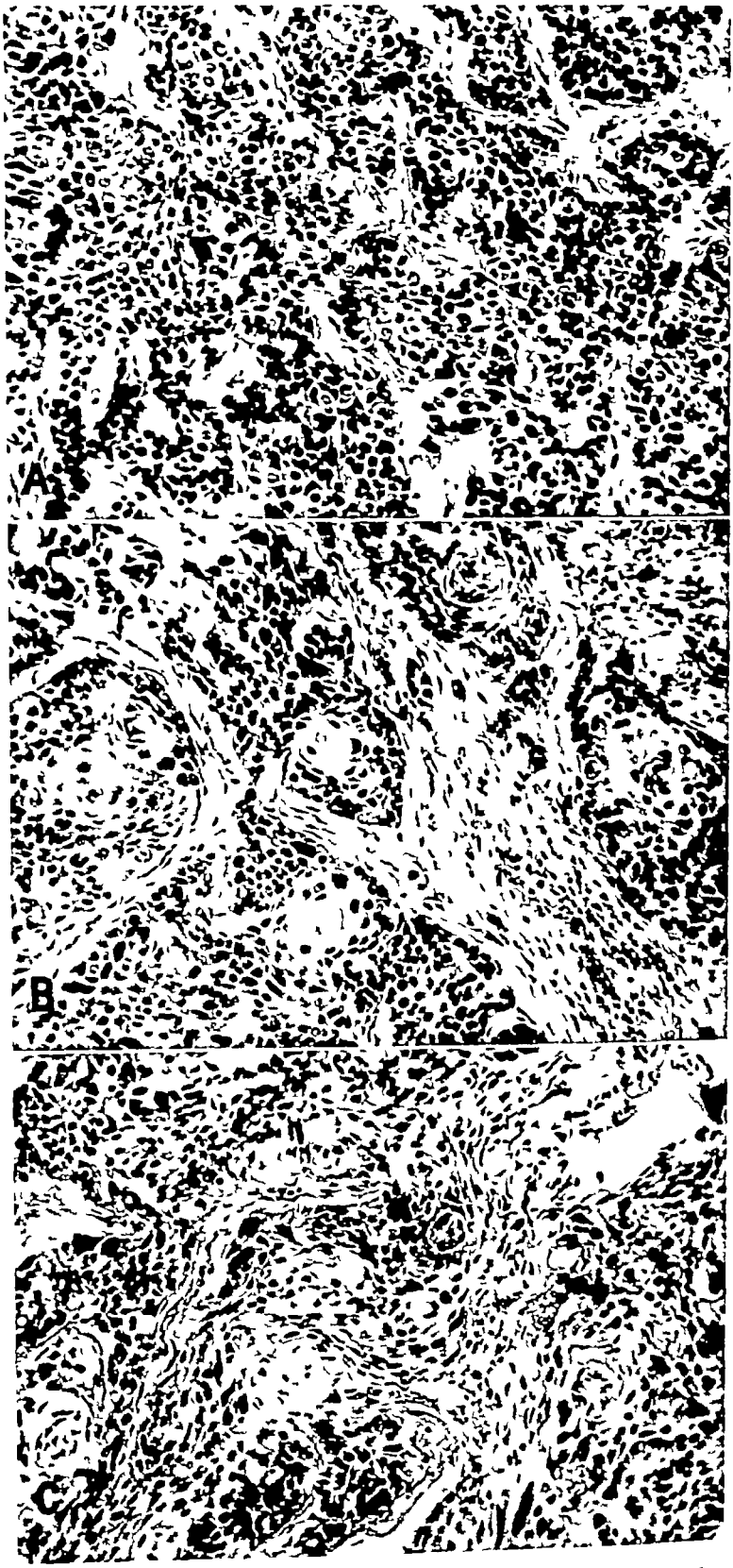

Fig 14 Undifferentiated carcinoma of tonsil, irradiated with inadequate daily tumor dose of 135 r (see Fig 2)

A Appearance before treatment There is no keratinization or stratification ×c 130

[*Legend continued on opposite page*]

lesser extent, primary degenerative changes and nuclear alterations in the connective-tissue cells

In a radiosensitive cellular tumor (Fig 15, A), the early disappearance of cells by lysis (acute cell death) exposes to view the underlying connective-tissue stroma Thus toward the end of the first week, there are seen areas of loose adult connective tissue that were originally obscured by tumor cells (Fig 15, B) The adult connective-tissue cells are characteristically spindle-shaped and have oval or spindle-shaped, darkly staining nuclei Many thin collagen fibers are present By the tenth day, however, there may be observed beginning proliferation of new connective tissue in the form of young fibroblasts growing into the areas formerly occupied by tumor cells This proliferation proceeds despite the fact that by this time the cumulative destructive effect of the daily fractional doses of radiation has reached a high intensity, sufficient to produce a second-degree reaction in the adjacent normal mucosa Thereafter the stroma becomes progressively denser, due chiefly to proliferation of fibroblasts but also to condensation of the pre-existing adult connective-tissue cells On the fourteenth day (Fig 15, C), there may be seen numerous moderately large areas of these young fibroblasts, some of which are maturing Between the fourteenth and twenty-first days the changes in the stroma just described are detectable clinically when the biopsy punch or scalpel encounters difficulty in cutting through the dense fibrous tissue Between the twenty-first and twenty-eighth days, the connective tissue progressively matures so that finally there is a dense stroma composed of hyalinized connective tissue (Fig 15, D and E)

In studying the effect of radiation on the stroma, the question arises as to whether the rate of replacement fibrosis is accelerated, retarded, or unchanged during irradiation A surgical wound will heal by the proliferation of young fibroblastic tissue in approximately five days However, in an area of destroyed tumor cells, replacement fibrosis may require ten to fourteen days to attain the same stage This period of delay is not quite so long as the above figures would indicate, because there is a latent period following irradiation exposure, before tumor destruction occurs and replacement fibrosis ensues Nevertheless, the process of replacement fibrosis following radiation destruction of tumor cells appears to be retarded

The rate and stage of replacement fibrosis depend upon the rate of destruction of the tumor cells The more radiosensitive tumor cells will degenerate early and soon be replaced by fibrous tissue The less sensitive cells degenerate more slowly, and replacement fibrosis is delayed Consequently, in most tumors that contain cells having different degrees of radiosensitivity, a particular biopsy specimen taken after irradiation may show all stages of fibrosis Thus, in Figure 15, E, taken from a relatively radiosensitive tumor, there has occurred early acute cell death with replacement of tumor by fibroblastic tissue that shows beginning hyalinization Figure 15, D, represents another less radiosensitive area of the same specimen, wherein the tumor cells did not degenerate simultaneously There is seen a central island of residual tumor cells undergoing destructive changes, surrounding this, in a zone where tumor cell destruction occurred previously, young fibroblasts are proliferating The periph-

B Biopsy on 21st day Tumor dose approximately 2,000 r A few peripheral cells of each cell mass have been destroyed There are early central keratinization and slight stratification. ×c 130

C Biopsy on 42nd day Tumor dose approximately 5 100 r The appearance of the tumor is materially different from the original biopsy specimen There are stratification and increased keratinization This is an example of a tumor maturing when exposed to prolonged inadequate irradiation ×c 130

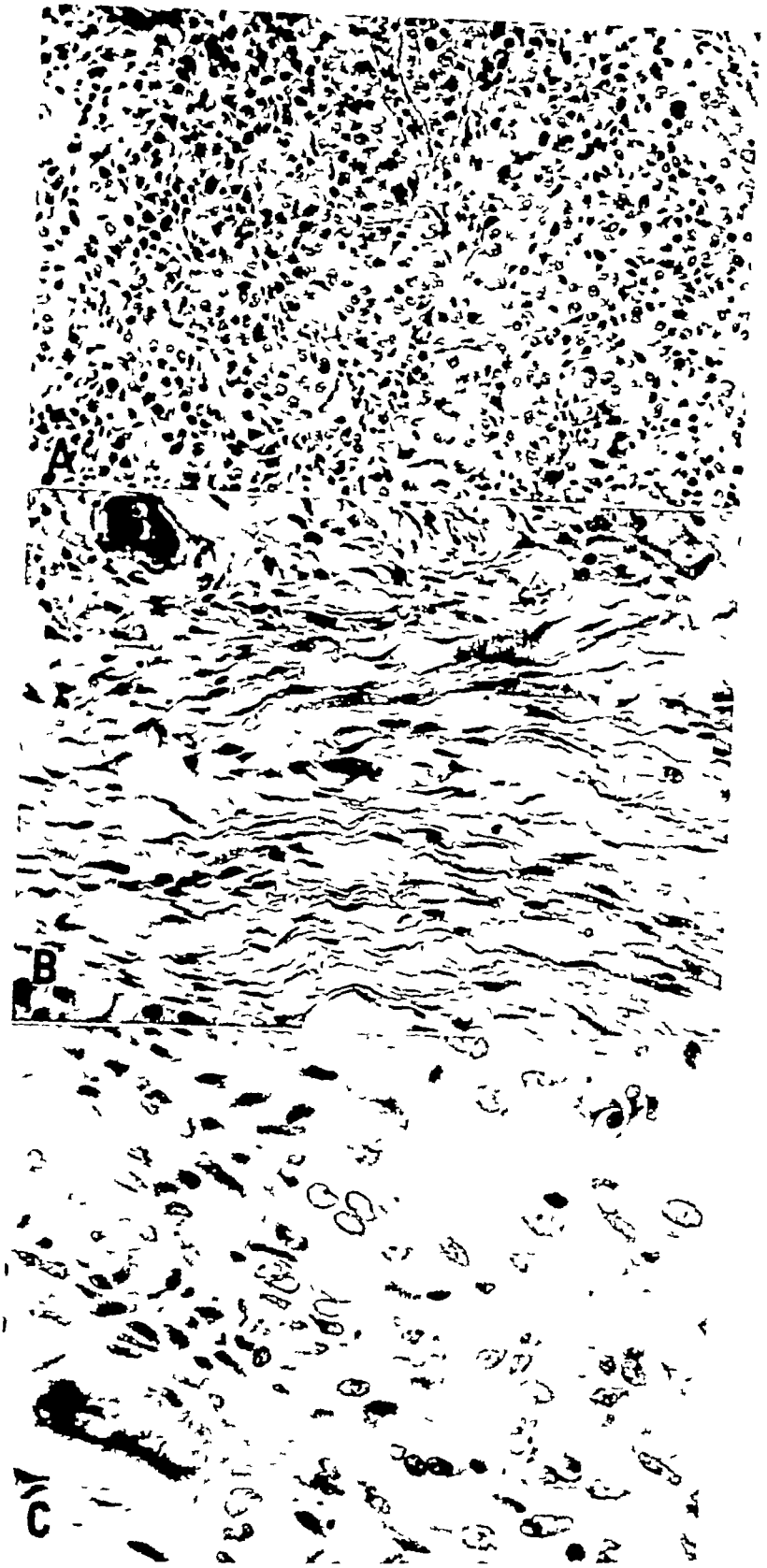

Fig 15 A-C Progressive stromal changes occurring in an undifferentiated squamous-cell carcinoma See also Fig 15, D–F A Appearance before irradiation ×250 [Legend continued on opposite page]

eral zone was the site where tumor cells were first destroyed and this is now occupied by mature connective tissue In a radioresistant tumor, there may be little replacement fibrosis because there has been little degeneration of tumor cells

The dominant stromal changes described above are secondary in nature, being those of replacement and reparative fibrosis Melnick and Bachem (1) found no direct changes in the stromal cells, when irradiating transplantable tumors with roentgen rays There did occur in some of our cases, however, a direct destructive effect on the connective-tissue cells and collagen fibers (Fig 15, F), both in the connective tissue of the tumor bed and in the replacement connective tissue, in their various stages of development These changes consisted of swelling of the young fibroblasts and occasionally of the more mature connective-tissue cells, slight to moderate vacuolation of the cytoplasm and the nucleus Infrequently, other degenerative changes were seen in the nucleus of stromal cells, such as pyknosis, karyorrhexis and karolysis, swelling and fragmentation of the collagen fibers, and, in one instance, multinucleated fibroblasts (Fig 15, C)

Although various combinations of these primary changes in stromal cells were observed in 16 of the 28 cases, they were generally mild in degree and affected a small percentage of the cells These changes first appeared on the seventh to tenth day and were most prominent during the interval from the fifteenth to the twenty-fifth day Apparently the cumulative radiation dose must be large before the ordinarily radioresistant connective-tissue cells can be injured

In addition to the direct destructive effect of radiation on the tumor cells, it is contended by some that residual radioresistant tumor cells become incarcerated in a dense, hyalinized connective-tissue bed This tissue is alleged to undergo progressive contracture resulting in asphyxiation destruction of some of the tumor cells It is our impression that the connective tissue plays little if any part in the destruction of the tumor cells themselves, but is predominantly a replacement fibrosis Somewhat confusing in this picture is the term, abortive fibrosis, introduced by Ewing (10) He was describing the occasional finding, as in a heavily irradiated endothelioma of bone, of intact tumor cells in a mass of relatively avascular, hyalinized connective tissue This is probably an abortive or incomplete radiation effect rather than an attempt on the part of the hyalinized connective tissue to destroy or abort the tumor cells, as interpreted by Ewing

Inflammatory Reaction in Tumor Tissue and Stroma

Cellular infiltration in the areas of replacement fibrosis, though slight, is composed predominantly of lymphocytes and plasma cells In later biopsy specimens, when there is moderate to marked destruction of tumor cells, polymorphonuclear leukocytes are present From a study of our material, we are unable to attribute any special significance to the cellular infiltration other than that associated with destruction and necrosis of tissue An acute inflammatory reaction is present in the superficial portions of many of these ulcerated tumors

Changes in Muscle

Radiation damage of the muscle fibers was noted in many of the biopsy specimens that included muscle tissue infiltrated with carcinoma The changes consisted of marked atrophy, fragmentation of muscle fibers, and swelling with loss of cross-striations Karyolysis, pyknosis, and even

B Biopsy on 10th day Destruction of tumor cells exposes a loosely arrayed adult stroma ×250

C Biopsy on 14th day Young fibroblasts are growing into the areas formerly occupied by tumor cells Generally these fibroblasts are little affected by radiation Occasionally, as illustrated above, the cytoplasm and nuclei show fine vacuolation ×375

Fig 15 D–F Same tumor as shown in Figure 15 A–C
D Biopsy on 24th day Progressive stromal changes around an island of degenerating tumor cells There is a zone containing a few fibroblasts beyond which is seen early hyalinization (upper right corner) ×250

[*Legend continued on opposite page*]

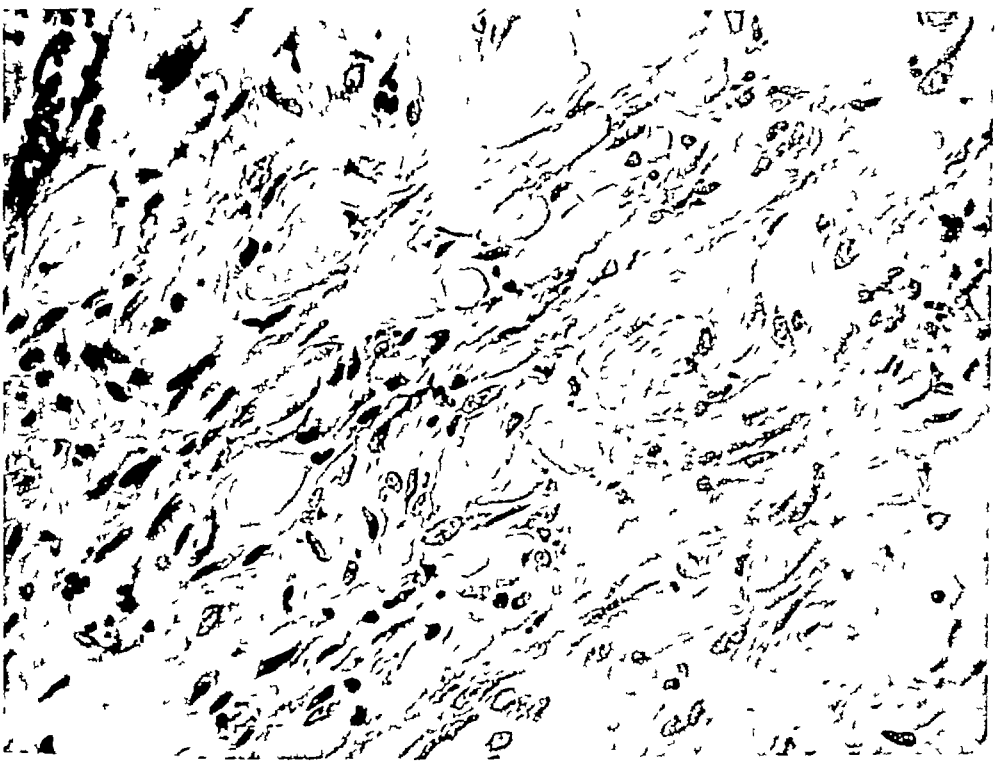

FIG 16 Degeneration of striated muscle fibers and early replacement of proliferating fibroblasts ×c 335

loss of nuclei were seen in the sarcolemma Scattered throughout these areas of degenerating muscle fibers were foci of proliferating connective-tissue cells (Fig 16)

Blood Vessels

The importance of the effect of radiation on the blood vessels of a tumor is controversial The earliest histologic studies, based on the effect of a single massive dose of radium, revealed extensive destruction of blood vessels allegedly resulting in local ischemic necrosis of tissues Other studies of the late effects of radiation disclosed obliterative endarteritis in varying degree, in association with replacement fibrosis and hyalinization of connective tissues These and other experimental and clinical observations, such as the relative radiosensitivity of a vascular tumor as compared with the radioresistance of an avascular tumor, led to the conclusion that the effect of radiation on blood vessels was an important mechanism of radiation destruction of a tumor

Reconsideration of these observations suggests that the single massive dose of radium exercised an overwhelming destructive effect on all types of cells and tissues and had no selective effect

Cramer (9) found occluded vessels in tumors one week after radium exposure, when active regression was beginning He concluded that there is a damaging effect of irradiation on the blood vessels both in normal tissues and in animal and human tumors Ewing (10) and Pullinger (11) also stressed the importance of blood vessel changes as a responsible factor for the death of cells Pullinger even contended that "all effects following irradiation result from stimulation and degeneration of blood vessels "

On the other hand, Melnick and Bachem

E Biopsy on 24th day Another area composed of dense connective tissue in which there is pronounced hyalinization ×250
F Biopsy on 28th day Swelling and fragmentation of collagen fibers in replacement connective tissue ×375

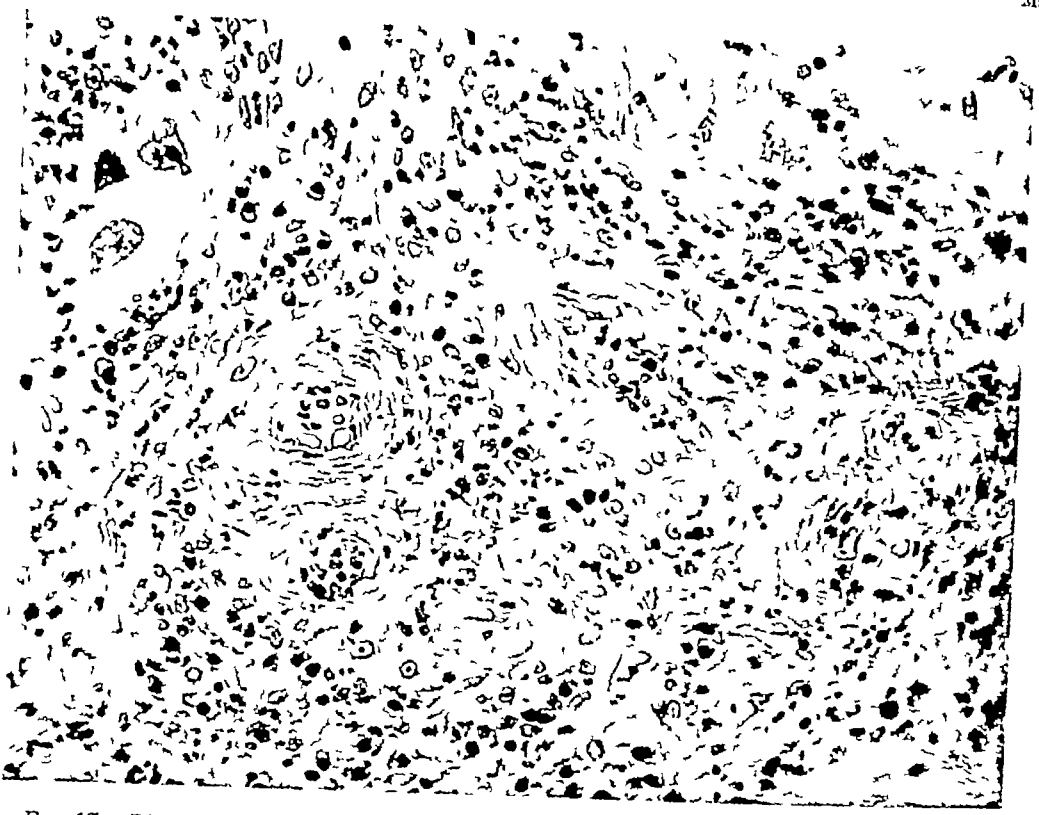

Fig 17 Blood vessel injuries swelling of endothelial cells and necrosis of vessel walls, with slight inflammatory cell infiltration The tumor stroma at the same time reveals a marked in flammatory reaction ×c 335

(1) concluded that all the evidence speaks for a primary action of the radiation on the tumor cells, and not on the stroma They found no changes in the blood vessels of connective tissue after the administration of doses as large as 12 to 15 skin erythema doses (6,300 to 7,975 r)

After making a preliminary survey of the tissue sections, it was our impression that fractionated external irradiation produced only minimal changes in the blood vessels of the tumor However, subsequent detailed analysis of each section, including a determination of the number of vessels affected, the type of vessel and the type of changes produced, indicated that radiation damage to vessels was present to some degree in almost every instance

The changes resulting from radiation injury of blood vessels have been described by many investigators These changes are swelling of the endothelial cells, mostly of the capillaries and only occasionally of the arterioles and small arteries, dilatation of the capillaries, necrosis of the walls of capillaries, venules, and arterioles, frequently accompanied by infiltration of their walls by polymorphonuclear leukocytes, thrombosis of arterioles and small arteries, usually associated with necrosis of the vessel wall or marked thickening of the wall (Fig 17) The most common finding in our material was dilatation of the capillaries with swelling of their endothelial cells This was observed at various times during irradiation up to the twenty-eighth day, and occasionally after irradiation The other changes occurred at various times during and after treatment They w frequently focal in nature, so that in single section, many vessels appear normal and only a few revealed the abov mentioned changes Occasionally, areas degenerated tumor cells were associat with vessels showing severe radiatic changes This would suggest that foc degeneration of tumor cells may occur nc only as a direct effect of radiation upo the cells, but also as a result of an indirec

effect through damage to the blood vessels

Of 22 tumors whose blood vessels were studied, minimal changes were found in 3, slight to moderate in 14, and marked in 5 From the analysis of this small group we can draw no conclusion as to the relationship between radiosensitivity of the tumor and vascular damage

Practical Application of Serial Biopsies

Fractionated roentgen therapy is, as a rule, administered over a period of twenty-three to twenty-eight days It is important to know, early in the course of treatment, the radiosensitivity of the tumor and the effectiveness of the radiation technic

In Figure 18 has been plotted the average "clinical" shrinkage curve of the tumors in this series, taken from graphs like that shown in Figure 1 It can be seen that by the eleventh day there is insufficient clinical shrinkage to prognosticate the future behavior of the tumor Also plotted in Figure 18 is a curve representing the average rate of destruction of the tumor as observed microscopically These results were obtained by evaluating all the cell changes described previously, but with special emphasis upon the percentage of viable cells in each biopsy specimen Analysis of the "histologic" curve indicates that between the seventh and eleventh days 25 to 50 per cent of the cells were destroyed In a tumor that is being effectively destroyed by irradiation, most of this destruction will have taken place by the process of acute cell death, which, in our opinion, is the most significant of all radiation effects Therefore, a single biopsy taken between the seventh and eleventh day will often demonstrate the effectiveness of the particular radiation technic sufficiently early to permit its alteration, if necessary

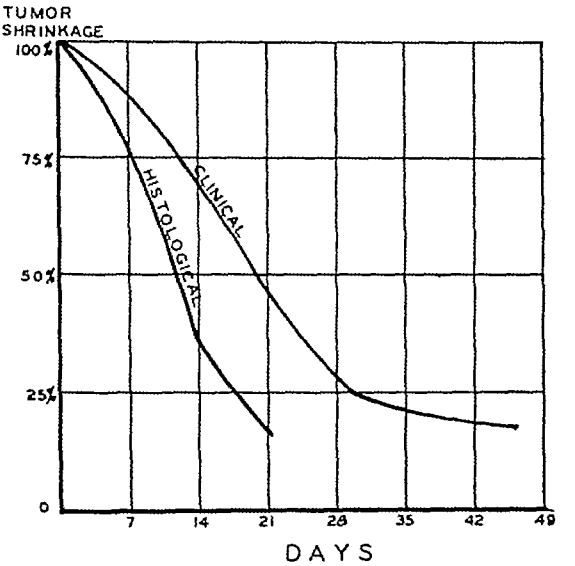

Fig 18 Study of rate of tumor destruction by comparison of average rate of clinical shrinkage with average rate of histologic destruction in the same series of cases

DISCUSSION

Histologically there are a number of methods whereby radiation produces destruction of tumor cells These processes occur simultaneously, although one type may predominate Certain features of the primary tumor may determine to some extent the mechanism of radiation destruction, *i e*, active keratinization in a tumor may be accelerated by irradiation, pleomorphism and multinucleation, when present in an unirradiated tumor, may be increased under irradiation, the cells of an undifferentiated tumor are prone to undergo acute cell death

The following is an attempt to classify the numerous radiation effects according to the types of histologic change and the mechanisms of production of such changes

I *Histologic Classification*

1 Acute cell death Manifested chiefly as lysis of the nucleus and cytoplasm, and to a lesser extent pyknosis and karyorrhexis of the nucleus

2 Radiation keratogenesis An acceleration of the normal process of keratinization

3 Progressive enlargement of the cell, with formation of giant sized tumor cells

(*a*) Swelling and vacuolation, probably due to physical-chemical alterations

(*b*) Enlargement of the cell with hyperchromatic or vesicular nuclei or multiple nuclei, probably due to chromosome alterations or interference with cell division

4 Metaplasia of glandular epithelium and hyperplasia of normal squamous epithelium [4]

[4] To be described in a future paper

5 Changes in mitochondria and Golgi bodies (Ludford, 12)

II *Mechanistic Classification*

1 *Primary Destructive Changes* These predominate when the cell is radiosensitive or the dose of radiation is large
   (*a*) Acute cell death
   (*b*) Delayed cell death
   (*c*) Destructive changes in connective tissue and blood vessels

2 *Disruptive Changes* These occur when the cell is less radiosensitive or when the amount of radiation is relatively small
   (*a*) Disruption of the reproductive mechanism of the cell, with formation of multinucleated cells or giant sized tumor cells with large, bizarre, hyperchromatic nuclei
   (*b*) Disruption of chemical processes Interference with intracellular and extracellular fluid exchange, probably due to radiation injury to the dialyzing membrane of the cell and nucleus and also to a physical chemical disturbance of the intercellular and intracellular fluids This results in diffuse swelling of the cytoplasm, and to a lesser extent of the nucleus, and may account for the formation of vacuoles in the cytoplasm and nucleus

3 *Acceleration Changes* Certain biologic processes may be accelerated
   (*a*) Radiation keratogenesis The process of keratinization is completed in a shortened period of time This is both maturation and degeneration
   (*b*) Untreated tumors, with some mutation forms, such as pleomorphism, hyperchromatism, and multinucleation, will, after irradiation, show these changes to be accentuated
   (*c*) Accelerated hyalinization of connective tissues

CONCLUSIONS

1 The destructive effect of radiation on squamous-cell carcinoma of the mouth and pharynx is achieved by several processes acute cell death, progressive enlargement of cells to giant-sized tumor cells, and radiation keratogenesis

2 Acute cell death is the most common change It affects the cytoplasm, nucleus, and other components of a cell impartially and is usually seen in the first seven days This is the process whereby the most radiosensitive cells are destroyed Its importance has not been sufficiently emphasized

3 The less sensitive cells, not undergoing acute cell death, show progressive enlargement to giant-sized tumor cells This is accomplished through two different mechanisms (1) swelling and vacuolation of the cytoplasm and to a lesser extent of the nucleus, probably through a physical-chemical disturbance of the intercellular and intracellular exchange of fluids, (2) disruption of the nuclear function, resulting in the formation of various nuclear abnormalities

4 Radiation keratogenesis, another mechanism of cell destruction, is the acceleration either in time or degree of the normal process of keratinization It is a cytoplasmic phenomenon

5 Under-irradiation of a tumor (chiefly in the form of an inefficiently small daily dose) produces some destruction of tumor cells, but chiefly provokes a maturation of the more radioresistant cells

6 The most pronounced change in the stroma is replacement fibrosis, secondary to and in proportion to radiation destruction of a tumor Irradiation also increases hyalinization of the connective-tissue stroma, and, to a slight extent, produces degenerative changes within some fibroblasts, namely swelling and vacuolation

7 With fractionated irradiation, damage to the blood vessels is usually slight, occasionally moderate in degree From the material studied, no conclusion can be drawn as to the relationship between radiosensitivity of the tumor and vascular damage

8 A single biopsy, taken between the seventh and eleventh day during a course of fractionated irradiation, will yield considerable information concerning the radiosensitivity of the tumor and the effectiveness of the irradiation technic

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SUMARIO

Alteraciones Histológicas Producidas en el Carcinoma Céluloescamoso de la Boca y Orofaringe por la Irradiación Externa Fraccionada con Rayos X

Para estudiar las alteraciones histológicas observadas en el carcinoma escamocelular de la boca y orofaringe así como ciertos problemas afines relacionados con los efectos de la radiación, obtuviéronse a varios plazos, por medio de biopsias, ejemplares de 28 enfermos que se hallaban en tratamiento

A 24 de los enfermos se les trató con una técnica tipo, recibiendo 400 r diarios a la piel (dosis diaria de 275 r al tumor) hasta una dosis total de 6,000 a 6,500 r por tumor en 23 a 28 días En los otros 4 enfermos se utilizó una técnica experimental, que consistió en la administración de una llamada "dosis diaria inadecuada," a saber, 200 r a la piel (dosis diaria de 135 r al tumor), o sea la mitad del tratamiento tipo, pero continuándola aproximadamente el doble de tiempo, obteniendo así una dosis total comparable Los factores físicos de la terapéutica fueron 200 kv 0 5 ó 2 0 mm de filtro de cobre, 20 ma, 50 cm de distancia foco-piel, dos portales laterales en el cuello, 10 × 15 cm (a veces 8 × 10 cm), capa de hemirreducción 0 9 6 1 8 mm de cobre, 10 a 40 r por minuto

Llegóse a las siguientes conclusiones

1 El efecto destructor de la radiación sobre el carcinoma escamocelular de la boca y orofaringe se obtiene con varios procesos muerte aguda de las células, hiperplasia progresiva de las células hasta convertirse en células neoplásicas gigantescas y queratogenia irradiatoria

2 La muerte aguda de las células es la alteración más común, afectando por igual el citoplasma, el núcleo y otros componentes celulares y soliendo observarse en los primeros siete días Este es el proceso con el cual se destruyen las células más radiosensibles y cuya importancia no ha sido suficientemente recalcada

3 Las células menos sensibles, que no experimentan una muerte aguda, se agrandan progresivamente hasta convertirse en células cancerosas gigantescas Esto se realiza mediante dos mecanismos distintos (1) inflación y vacuolación del citoplasma y en menor grado del núcleo, probablemente por virtud de un trastorno físicoquímico del intercambio inter- e intracelular de líquidos, y (2) perturbación de la función nuclear, dando por resultado la formación de varias anomalías nucleares

4 La queratogénesis irradiatoria, otro mecanismo de destrucción celular, representa la aceleración, bien en velocidad o intensidad, del proceso normal de queratinización, siendo un fenómeno citoplásmico

5 La subirradiación de un tumor (principalmente en forma de una dosis

diaria ineficientemente pequeña) produce alguna destrucción de las células cancerosas, pero principalmente provoca maduración de las células más radiorresistentes

6 La alteración más pronunciada en el estroma consiste en fibrosis de sustitución, secundaria y proporcional a la destrucción irradiatoria de un tumor La irradiación también acrecienta la hialinización del estroma del tejido conjuntivo, y en menor grado, produce en el interior de algunos fibroblastos, alteraciones degenerativas, a saber, inflación y vacuolación

7 Con la irradiación fraccionada, el daño experimentado por los vasos sanguíneos suele ser leve, y a veces moderado Del material estudiado, no puede sacarse conclusión alguna acerca de la relación entre la radiosensibilidad del tumor y la lesión vascular

8 Una sola biopsia, ejecutada entre el séptimo y el undécimo día de una tanda de irradiación fraccionada, facilitará considerable información con respecto a la radiosensibilidad del tumor y la efectividad de la técnica irradiatoria

Suppurative Bronchopneumonia with Cavitation[1]

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DURING THE WINTER and spring of 1944–45, the authors saw approximately 3,500 cases of pneumonia at a naval hospital In this group there were 7 cases of a rather bizarre type of bronchopneumonia characterized by parenchymal suppuration and necrosis with cavity formation Because this entity is not particularly well known and the pertinent radiologic literature is sparse, these cases will be reported in some detail

Although several fragmentary references had been made to the pathology of this disease in the continental literature (1, 2, 4, 6, 10, 11, 21, 28), no adequate description of the clinical and roentgen findings was recorded prior to Kessel's report, in 1930 (9) That investigator noted the clinical and roentgen aspects of 5 cases in detail and appended a gross and microscopic description of 3 additional cases which came to necropsy In general, credit for a proper understanding of this disease must go to the Mt Sinai Thoracic Group, whose investigations have led to a clear concept of the pathogenesis of suppurative bronchopneumonia (16, 17, 18, 19, 20, 27, 29)

INCIDENCE

The incidence of suppurative bronchopneumonia in our series was 0 2 per cent (7 cases in a group of 3,500 pneumonias) That this lesion is not a rarity is well demonstrated by the fact that the Mt Sinai group was able to accumulate a series of 120 cases during a period of ten years (18) Many cases, particularly the milder ones, are probably overlooked because of a general unfamiliarity with the lesion

The Mt Sinai investigators reported an equal incidence in the sexes and an occurrence in all age groups There seems, however, to be a preponderant frequency in children and young adults

ETIOLOGY

The bacteriology of necrosuppurative bronchopneumonia as determined in our cases is based upon cultures of the sputum obtained prior to the institution of chemotherapy In 4 cases, a pure culture of B-hemolytic streptococcus was found In the remaining 3 cases, no abnormal pathogens could be cultured The explanation for the presence of the B-hemolytic streptococcus may lie in the fact that many of the cases of pneumonia followed in the wake of an epidemic of scarlet fever Other investigators have incriminated *Staphylococcus aureus*, *Pneumococcus*, and *Streptococcus viridans* as well as the B-hemolytic streptococcus as causative organisms (18) In almost all of the cases reported in the literature, a pure culture of the offending organisms has been found in the pus or necrotic lung tissue, in contradistinction to the mixed infections present in anaerobic lung abscesses

PATHOLOGY

In the few cases which have come to autopsy, the lesions, either single or multiple, consisted of a bronchopneumonia with varying degrees of suppuration and

[1] Presented at the Second Inter-American Congress of Radiology, Havana, Cuba, Nov 17–22, 1946 Accepted for publication in May 1947

necrosis The infection usually involved one or more bronchopulmonary segments, with extension to the pleura Gross abscess formation was noted with coalescence of suppurative areas of destroyed alveolar septa and bronchi Two types of bronchopneumonia with abscess formation occur the type in which focal necrosis is secondary to a predominantly suppurative pneumonic lesion and the type in which the abscess formation is foremost and the surrounding pneumonitis is minimal

Microscopically, the areas of suppuration are diffuse throughout the involved segment of lung The alveoli and bronchioles are distended with pus The explanation for the necrosis is twofold, lying first in the suppurative process itself and, second, in inflammatory vascular lesions resulting in thrombosis and anemic infarction The latter process is well described in Kessel's original contribution (9)

CLINICAL FEATURES

The clinical symptoms of suppurative bronchopneumonia are fever, cough, and the expectoration of purulent sputum Frequently, there is a history of an antecedent upper respiratory tract infection Pleuritic pain is common The disease most often occurs in young healthy individuals

There are no characteristic physical findings The signs are those of any bronchopneumonic infiltration and are often insignificant compared with the lesion seen on the roentgen film Because of the pneumonitis, physical signs of cavitation are frequently not detectable Nor is there anything characteristic about the blood count Most commonly, there is a moderate leukocytosis, but this is not always present In the more protracted cases, a secondary anemia may be noted

From the clinical point of view, the cases may be grouped into four varieties

1 The first group comprises those cases in which the clinical course and laboratory findings are those of an ordinary bronchopneumonia, except for the roentgen demonstration of cavitation Most of these cases have an uncomplicated recovery

2 The second group includes the more severe, protracted cases which tend to spread to new bronchopulmonary segments Some of the patients go on to spontaneous recovery after weeks or months of prolonged relapsing illness In others chronic bronchiectasis develops, secondary to the pulmonary suppuration and superimposed atelectasis with its resultant interstitial fibrosis

3 The third group consists of the cases with local surgical complications

(*a*) *Aerobic pulmonary abscess* This is an infrequent complication of suppurative bronchopneumonia In the typical case, the abscess is unilocular, solitary, superficially located, with adherence of the overlying pleura The cavity contains a varying amount of pus and air, depending on the degree of patency of the communicating bronchus or bronchi

(*b*) *Pleural involvement with empyema or pyopneumothorax* The abscess may rupture into the pleural space, resulting in either a localized or diffuse empyema Air in the pleural space may or may not be demonstrable on the roentgen film The absence of air may be due to compression of the perforation by the empyema fluid

4 The fourth group includes those cases in which general or regional spread has occurred

(*a*) *Cerebral involvement* is a rare complication of the severe form of the disease and is characterized by either a suppurative meningitis or cerebral abscess formation

(*b*) Rarely, diffuse *septic embolic phenomena* with metastatic abscess formation may take place secondary to the pulmonary suppuration and its associated septic thrombophlebitis

(*c*) *Mediastinitis and pericarditis* may occasionally occur as direct extensions from the pulmonary lesions

ROENTGEN CHARACTERISTICS

Because of the paucity and the nonspecificity of the clinical symptoms and

signs, the diagnosis of suppurative bronchopneumonia depends primarily upon the roentgen findings The cardinal feature is the presence of one or more areas of cavitation within an area of pneumonic consolidation The bronchopneumonic infiltration may be multiple or confined to one bronchopulmonary segment There may be some difficulty in distinguishing the areas of cavitation from irregular areas of radioparency due to a resolving pneumonia However, the early appearance of the cavitation in the course of the disease, its sharply defined borders, and an air fluid level (when the latter is present) usually make differentiation possible In doubtful cases, laminagraphy may be of considerable value

The cavity may be single *ab initio* or may result from the coalescence of several smaller cavities The cavities may rapidly diminish in size and disappear This is probably due to closure of the communicating bronchus On the other hand, a rapid increase in the size of the cavity may take place in the face of resolution of the surrounding pneumonic infiltration Simultaneously, the outline of the cavity may become circular and more sharply defined In all likelihood, this is due to partial occlusion of the communicating bronchus by inflammatory exudate, producing a ball-valve effect These tension cavities may persist for long periods of time, and have undoubtedly been mistaken for congenital pneumatoceles In the absence of cavitation, there is no one roentgen sign which is pathognomonic of suppurative bronchopneumonia However, Rabin believes that the presence of atelectasis and emphysema, due to bronchial obstruction by inflammatory exudate, should suggest that the pneumonia is of the suppurative variety Furthermore, he feels that slow resolution should raise a similar suspicion (20)

The solitary abscess cavity or the multiple areas of cavitation may rupture into the pleural space, resulting in a localized or diffuse empyema or pyopneumothorax This frequently obscures the underlying pulmonary lesion Roentgen differentiation of a pyopneumothorax from an unperforated lung abscess may sometimes be difficult or even impossible Neuhof and Touroff (19) mention two roentgen features which are suggestive of pyopneumothorax (*a*) The fluid level frequently extends to the thoracic cage, with no intervening lung (*b*) Roentgenoscopically the fluid level is usually more mobile than in pulmonary abscess

DIFFERENTIAL DIAGNOSIS

The diagnosis of suppurative bronchopneumonia can usually be made from a combination of the clinical and roentgen findings However, the more severe forms may require differentiation from other disease, *e g*, pulmonary tuberculosis, putrid lung abscess, bronchogenic carcinoma, actinomycosis, and atypical (virus) pneumonia Tuberculosis can be excluded by repeated smears and cultures of the sputum If the latter is scanty, bronchoscopic aspiration may be necessary Similarly, bronchoscopy may be invaluable in the differential diagnosis of bronchogenic carcinoma In the rare case of putrid lung abscess with a blocked bronchus, there may be no foul sputum The diagnosis may then be in abeyance until the appearance of a foul sputum or a putrid empyema

The irregular mottled appearance of an atypical (virus) pneumonia may simulate suppurative bronchopneumonia However, the leukopenia, the absence of purulent sputum, and the subsequent roentgen course of the disease should make the correct diagnosis apparent

Rare suppurative lesions such as actinomycosis can be properly differentiated only after repeated bacteriologic study of the sputum

TREATMENT

In the first two clinical groups, *i e*, pulmonary abscess incidental to extensive necrosuppurative bronchopneumonia and pulmonary abscess as the predominant factor with a surrounding necrosuppurative

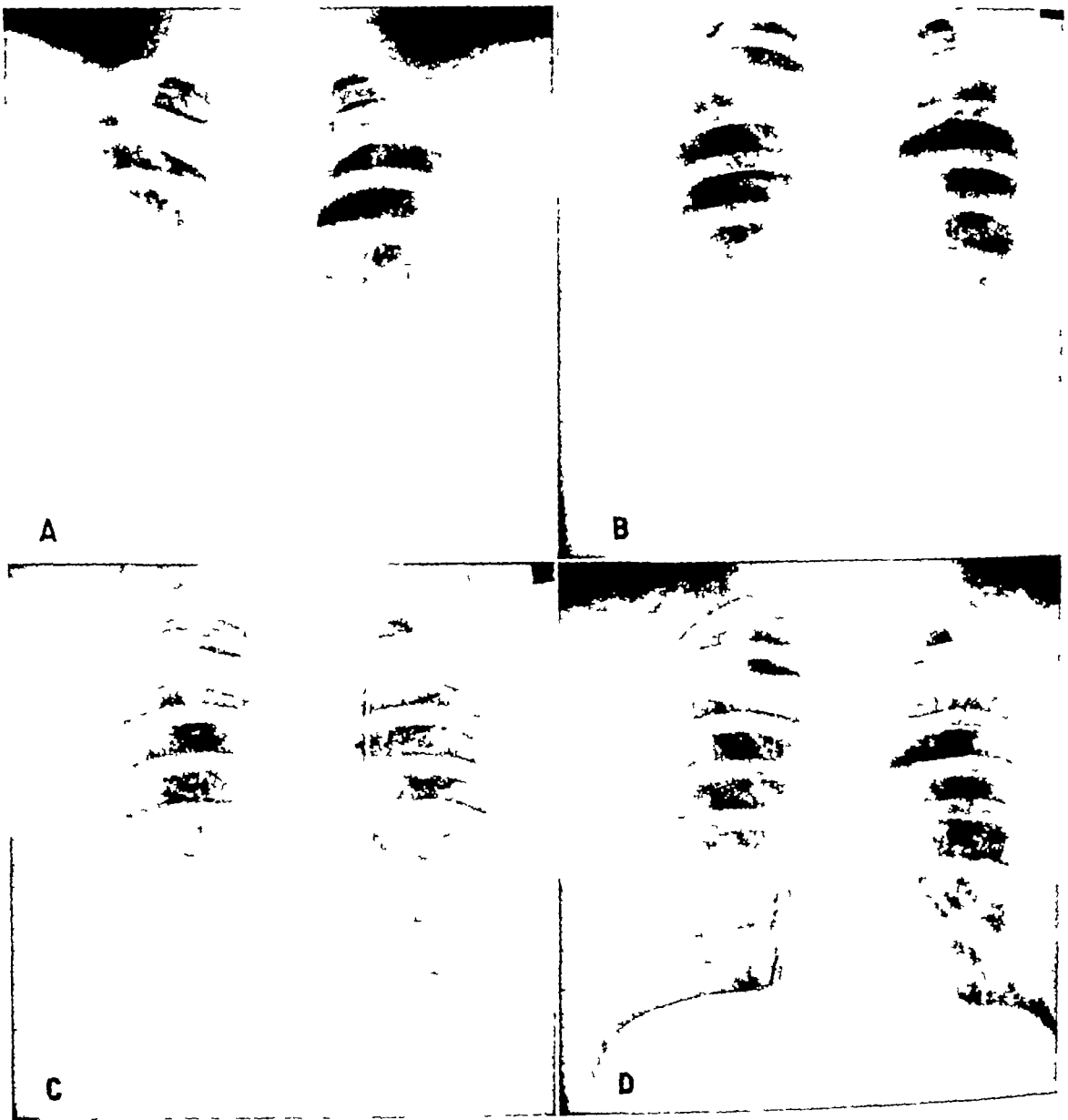


FIG 1 Case 1 A At onset of pneumonia lesion in right lower lobe, no cavitation B Six days after onset area of cavitation has appeared C Twenty-one days after onset cavitation persists D Two months after onset lung clear

pneumonic infiltration, surgical intervention is not necessary (18, 19) The disease usually resolves spontaneously, less frequently it eventuates in bronchiectasis The pulmonary and pleural complications, however, require surgical management The true encapsulated aputrid lung abscess surrounded by a narrow reaction zone of inflammatory tissue is the only pulmonary lesion for which operative treatment may be indicated Neuhof and Touroff (19) state that there is no operative mortality, little postoperative morbidity, and a complete cure in the latter type of case On the other hand, imminence of or actual perforation into the pleural cavity is a real indication for surgical intervention Similarly the regional extensions into the mediastinum and pericardium and the metastatic abscesses require surgical drainage, but the prognosis in these complications is grave

Although our series of cases is small, there is good evidence to suggest that

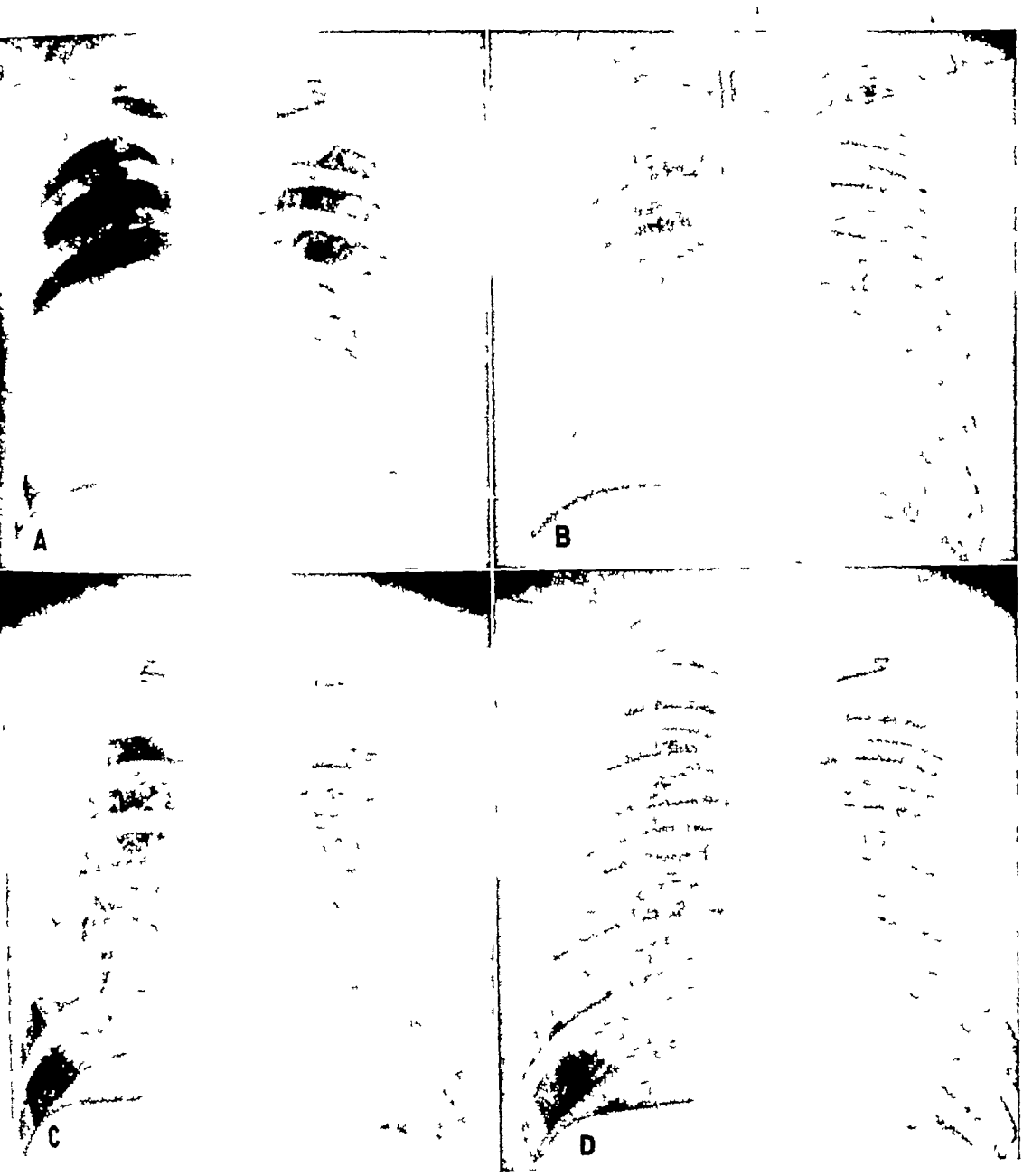


Fig 2 Case 2 A At onset of pneumonia area of cavitation in center of right lower lobe lesion B Five days after onset considerable decrease in lesion, cavity somewhat smaller C One month after onset almost complete clearing D Six weeks after onset lungs clear

penicillin is of definite value in the treatment of this disease The use of penicillin has resulted in a marked reduction in toxicity and has probably served to prevent the occurrence of the more serious complications

CASE REPORTS

CASE 1 A D, 18 year-old apprentice seaman, admitted to the hospital on April 9, 1945, with a diagnosis of acute coryza Unfortunately his clinical record was misplaced, so that only fragmentary information is available

Laboratory Examinations Sputum culture on April 24 yielded only normal pharyngeal organisms On April 25, a blood culture showed no growth

Roentgenograms of the Chest On April 10, an area of pneumonic infiltration in the supradiaphragmatic portion of the right lower lung field was noted Re-examination on April 24 showed suggestive evidence of cavitation, which was confirmed Further study, May 1, demonstrated some resolution of the pneumonitis but persistence of the cavity On

May 10, further resolution of the pneumonitis was noted and also some diminution in the size of the cavity The latter was almost entirely gone by May 16 On June 19, repeat roentgen study showed only a slightly increased prominence of the bronchovascular trunk markings at the site of the lesion but no evidence of cavitation Bronchoscopy was performed on July 12 and a normal bronchial mucosa was found Lipiodol was instilled and no evidence of bronchiectasis could be found The patient was discharged to duty, well, on Aug 2, 1945

CASE 2 T G, 18-year-old apprentice seaman, was admitted to the hospital on June 11, 1945, with a diagnosis of possible bronchopneumonia

History The past history was irrelevant A week before admission, the patient reported to the local naval dispensary complaining of sore throat, fever, and cough Although originally non-productive, the cough soon became productive of a mucopurulent sputum There had been no chest pain, dyspnea, or hemoptysis

Physical Examination The temperature on admission was 99 4° F, the pulse rate 88 per minute, and the respirations 20 per minute There were no positive physical findings except for slight injection of the pharynx

Laboratory Examinations The red blood count was 4,390,000 cells per cubic millimeter The white blood count was 13,400, with 65 per cent segmented polymorphonuclear leukocytes, 2 per cent nonsegmented polymorphonuclear leukocytes, 28 per cent lymphocytes, and 5 per cent monocytes

Roentgenogram of the Chest A chest film showed an area of pneumonic consolidation occupying the right middle lobe area, with an irregular radiolucent cavity in the superior portion of the lesion There were also flocculent pneumonic infiltrations along the trunks to the left base

Course Four grams of sulfadiazine were given immediately, followed by 1 0 gm every four hours This was discontinued on June 12, at which time penicillin therapy was started in a dosage of 15,000 units intramuscularly every three hours The dose was reduced to 10,000 units every three hours June 18, and the drug was discontinued completely on June 20 On June 14, the patient was considerably improved His temperature was normal but he was raising a moderate amount of yellow mucoid sputum which was not foul in odor Re-examination of the chest, June 16, showed further resolution of the pneumonic process in the right mid lung field The areas of cavitation were still demonstrable but their borders were much less distinct There was almost complete resolution of the pneumonia in the left lower lobe at this time There was, however, an afternoon elevation of temperature to 100–101° F By June 21, the patient was afebrile and had only occasional cough, productive of a very scanty sputum On July 2, further resolution was noted on the roentgen film Re examination of the chest on July 11 showed complete resolution of the pneumonic process with no residual evidence of cavitation The patient was discharged to duty, well, on July 30

CASE 3 H R, 18-year old apprentice seaman, was admitted to the hospital on June 23, 1945, with a diagnosis of scarlet fever

History The past history was irrelevant Two days before admission, the patient had a sore throat The following day he noticed a diffuse rash over his body and a cough productive of a thick, tenacious sputum

Physical Examination The temperature on admission was 103 6° F, the pulse rate 130 per minute, and the respirations 26 per minute The pertinent physical findings were marked reddening of the pharynx, a strawberry tongue, bilateral cervical adenopathy, and a typical scarlatina rash

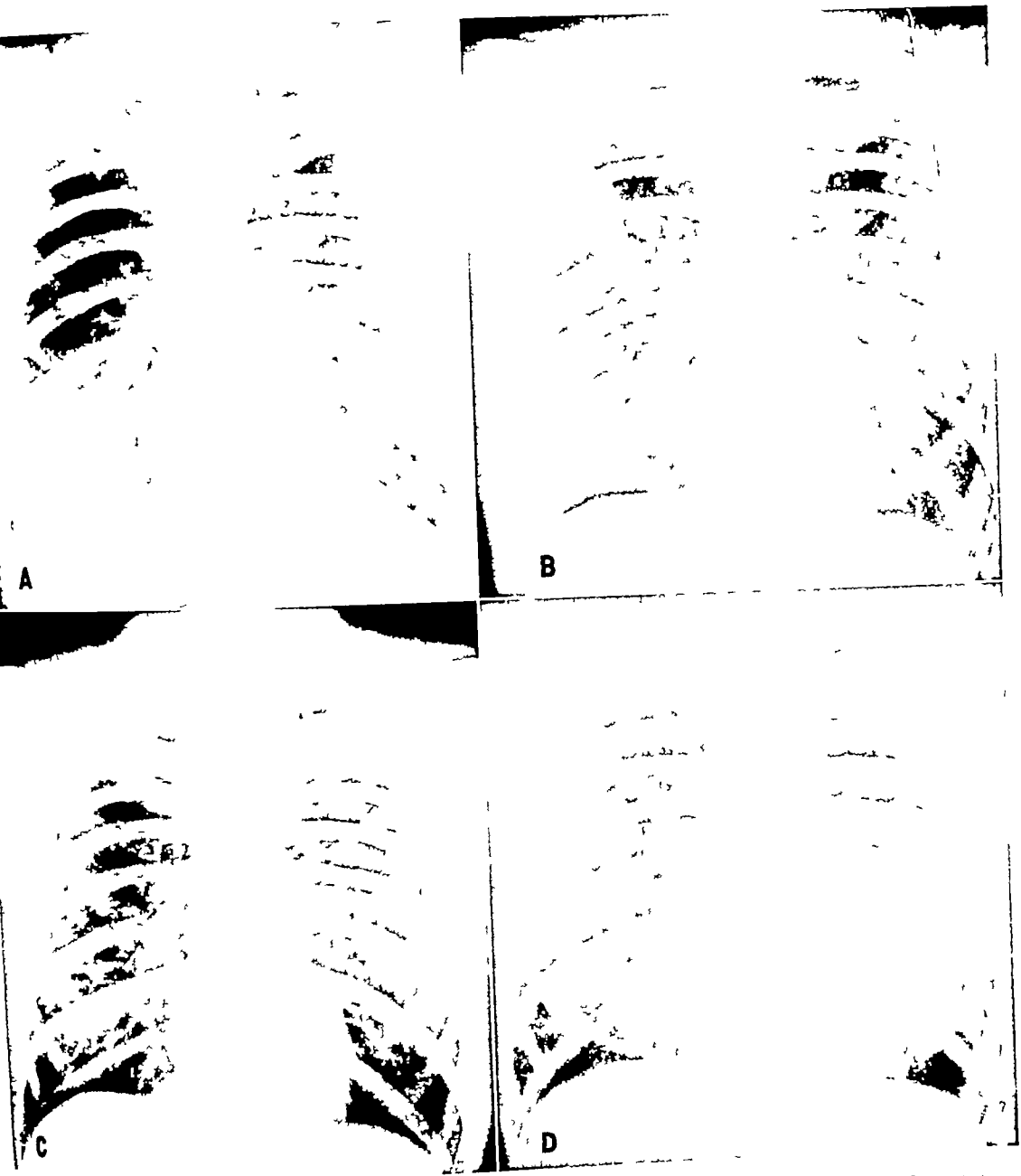
Laboratory Examinations Throat cultures failed to demonstrate any evidence of B-hemolytic streptococcus Only the normal pharyngeal organisms were obtained

Course Penicillin, 20,000 units every three hours, was given intramuscularly The temperature dropped to normal in the next several days and the drug was discontinued on June 28 At that time the patient was asymptomatic On July 3, his temperature rose to 102° F, and he began to complain of pain in the right side of the chest Roentgen examination of the chest at this time showed an area of pneumonic consolidation at the right base, with a central zone of rarefaction Penicillin was again started, in the same dosage as before, and the temperature abruptly fell to 99° F the next morning The penicillin was discontinued on July 4 because of marked urticaria Roentgen examination of the chest on July 11 showed considerable resolution

On July 12, the temperature again rose to 104° F, and the patient complained of a cough productive of mucoid sputum Some fine râles over the right mid-lung field posteriorly were noted at this time. Sulfadiazine, 1 0 gm three times a day, was started on July 13 The next day the patient felt much better By July 16, his temperature had returned to normal and he was asymptomatic Sulfadiazine was discontinued on July 19 On July 23, re examination of the chest showed further resolution of the pneumonic process Repeat roentgen study on Aug 6 showed both lung fields clear The patient was discharged to duty, well, on Aug 21

CASE 4 H R, 17-year old apprentice seaman was admitted to the hospital on May 26, 1945, with a diagnosis of pneumonia of the left lower lobe

History The past history was non-contributory For two weeks prior to admission the patient complained of chills, fever, malaise, weakness, and a cough productive of a tenacious, purulent sputum, which was blood-streaked on one occasion On the morning of admission, sharp pain developed in the left chest, aggravated by breathing or coughing



g 3 Case 3 A At onset of pneumonia lesion in right lower lobe, with several small areas of cavitation ight days after onset lesion resolving few small areas of cavitation remaining C Twenty days after on- almost complete resolution D Thirty-three days after onset lungs clear

hysical Examination The temperature on ad- ssion was 105 4° F , the pulse rate 112 per minute, d the respirations 50 per minute The important ysical findings were an inflamed pharynx, bilateral vical adenopathy, and dullness, diminished ex- nsion and breath sounds over the left lower lobe steriorly A faint friction rub was heard at the vel of the ninth left rib in the mid axillary line

Laboratory Examinations The red blood count as 4 000,000 cells per cubic millimeter with 11 5 m. hemoglobin The white blood count was 28,450, with 73 per cent segmented polymorphonu- clear leukocytes, 18 per cent non segmented poly- morphonuclear leukocytes, and 9 per cent lympho- cytes Cultures of the sputum yielded a pure growth of B hemolytic streptococcus and no tubercle bacilli

Roentgenogram of the Chest On May 26, a chest film showed small patches of pneumonic infiltration along the trunks to both bases more marked on the right side

Course The patient was placed in an oxygen

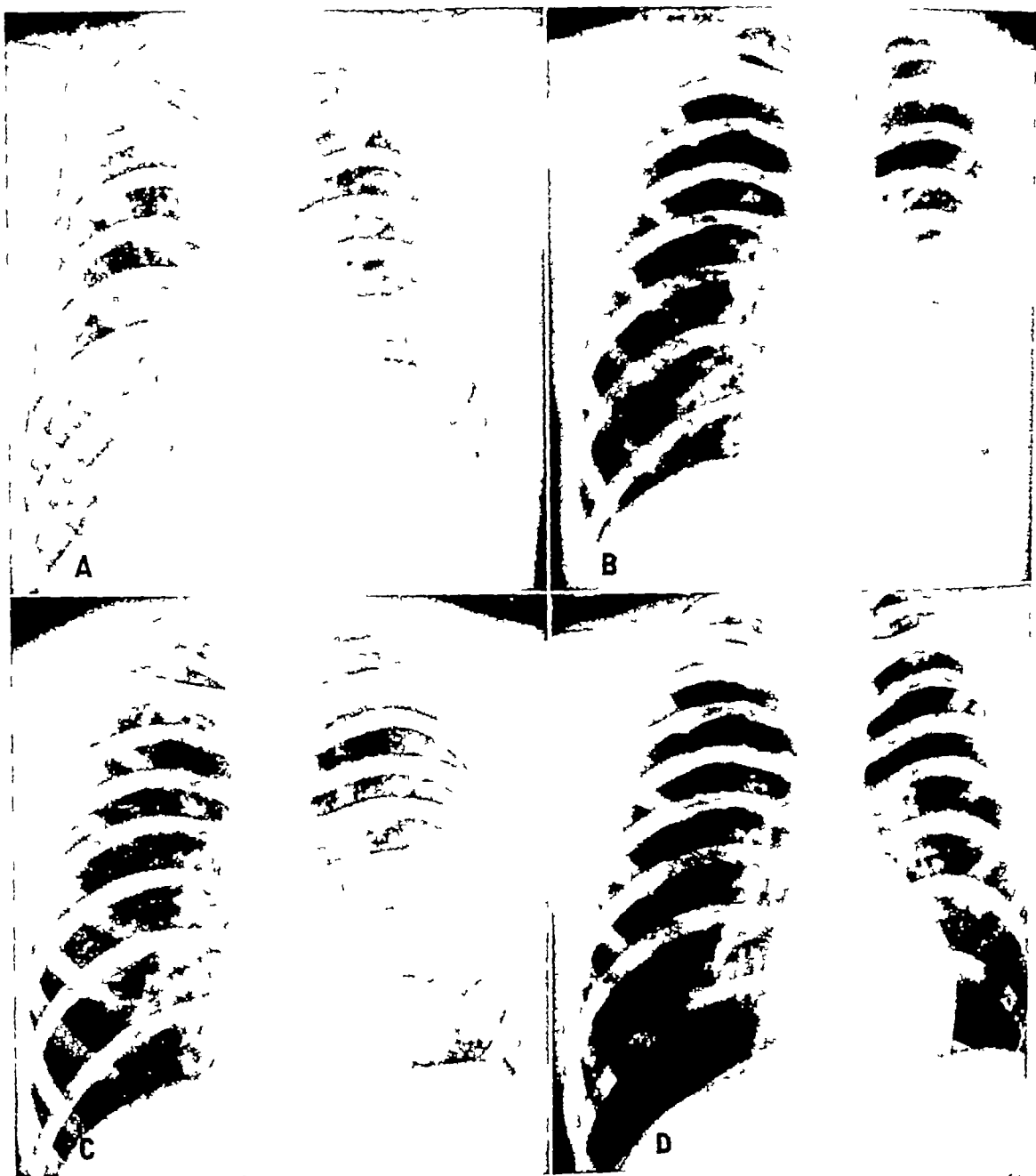


FIG 4 Case 4 A At onset of pneumonia lesions along trunks to both bases, more marked on right B Twelve days after onset right lower lobe clear, extension of process in left lower lobe, with area of cavitation in upper part of lesion C One month after onset considerable clearing of lesion, with persistence of small cavity D Ten weeks after onset both lungs clear

tent, and 30,000 units of penicillin were given intramuscularly every three hours The temperature fell to 99° F , by crisis, overnight The following day, however, it rose to 103° F , and physical signs of fluid in the left pleural cavity appeared A thoracentesis was performed, and 75 c c of slightly cloudy, thin, yellow fluid was removed Direct smear showed a few polymorphonuclear leukocytes but no organisms There was no growth on culture Roentgen examination of the chest following thoracentesis disclosed some resolution of the pneumonic process in the right lower lobe and an effusion in the left pleural cavity

On June 6, thoracentesis of the left pleural cavity was again performed but only 25 c.c of fluid was obtained Direct smear at this time showed numerous polymorphonuclear leukocytes and a few gram-positive diplococci Again there was no growth on culture On June 7, two abscess cavities were noted in the left lower lobe Penicillin was

Fig 5 Case 5 A At onset of pneumonia area of pneumonia in lower part of left upper lobe, with a large irregular area of cavitation B Fourteen days after onset considerable resolution of lesion, with some reduction size of cavity C Twenty-four days after onset further resolution with persistence of small area of cavitation Thirty-seven days after onset lungs clear

discontinued on June 9 because of the occurence of severe urticaria

By June 19, the temperature returned to normal and remained so thereafter Physical examination on this date showed diminished expansion of the left side of the chest and signs of pleural thickening The patient was clinically well except for a slight cough productive of a small amount of sputum On June 26, repeat roentgen examination revealed considerable absorption of the fluid in the left pleural cavity Some residual pleural thickening and elevation of the left dome of the diaphragm were noted The abscess cavity was definitely smaller in size

By July 9 there was complete disappearance of the abscess cavity, and re examination on July 26 demonstrated only a slight degree of pleural thickening in the left lower lobe On August 6 the vital capacity was 3 5 liters By Aug 23, it had increased to 4 liters At the latter time, chest expansion was normal bilaterally, and only minimal pleural thickening in the left costophrenic angle could be demonstrated on the roentgen film The patient was discharged to duty, well, on Aug 27

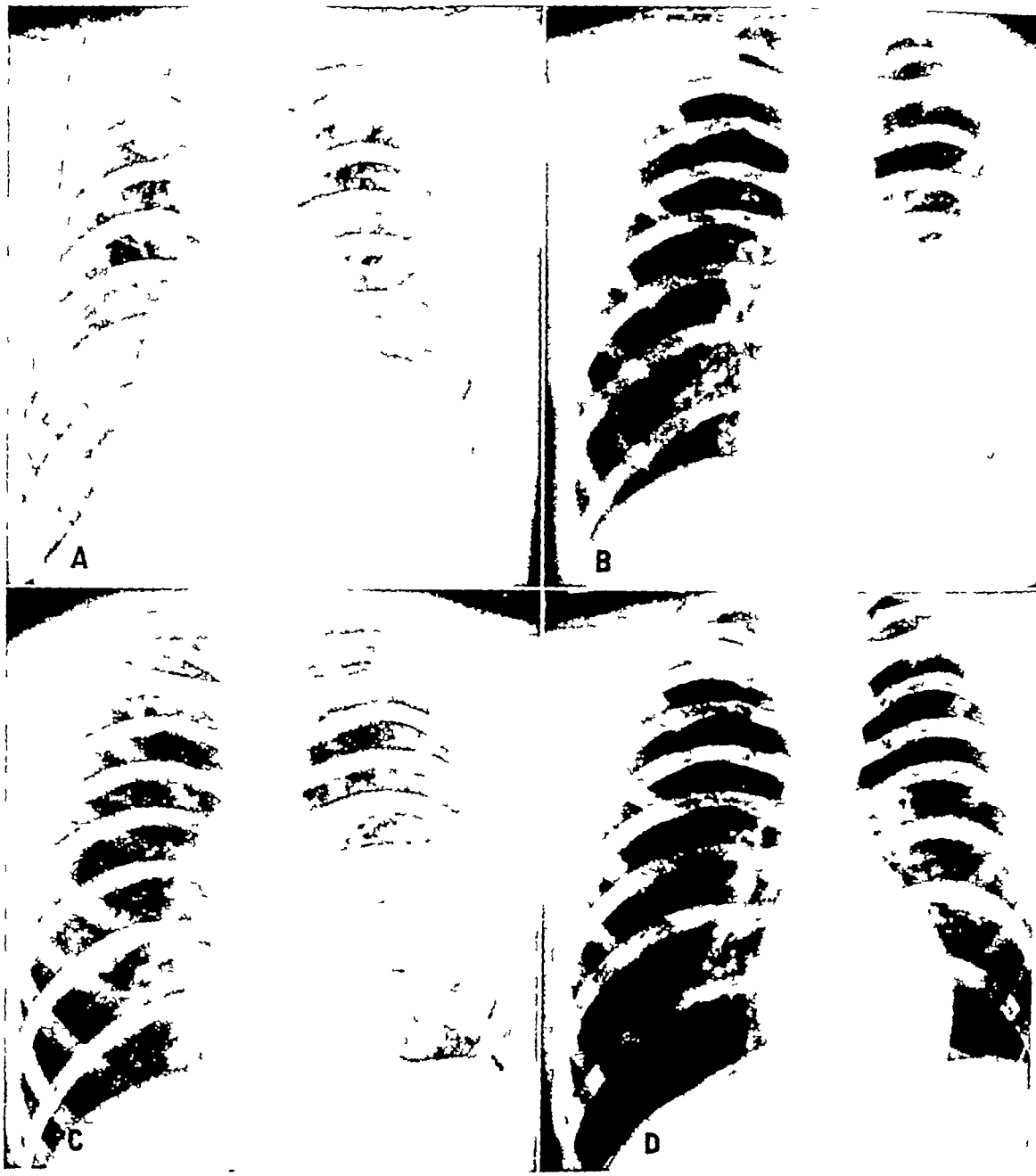


Fig 4 Case 4 A At onset of pneumonia lesions along trunks to both bases, more marked on right B Twelve days after onset right lower lobe clear, extension of process in left lower lobe, with area of cavitation in upper part of lesion. C One month after onset considerable clearing of lesion, with persistence of small cavity D Ten weeks after onset both lungs clear

tent, and 30,000 units of penicillin were given intramuscularly every three hours The temperature fell to 99° F , by crisis, overnight The following day, however, it rose to 103° F , and physical signs of fluid in the left pleural cavity appeared A thoracentesis was performed, and 75 c c of slightly cloudy, thin, yellow fluid was removed Direct smear showed a few polymorphonuclear leukocytes but no organisms There was no growth on culture Roentgen examination of the chest following thoracentesis disclosed some resolution of the pneumonic process in the right lower lobe and an effusion in the left pleural cavity

On June 6, thoracentesis of the left pleural cavity was again performed but only 25 c c of fluid was obtained Direct smear at this time showed numerous polymorphonuclear leukocytes and a few gram-positive diplococci Again there was no growth on culture On June 7, two abscess cavities were noted in the left lower lobe Penicillin was

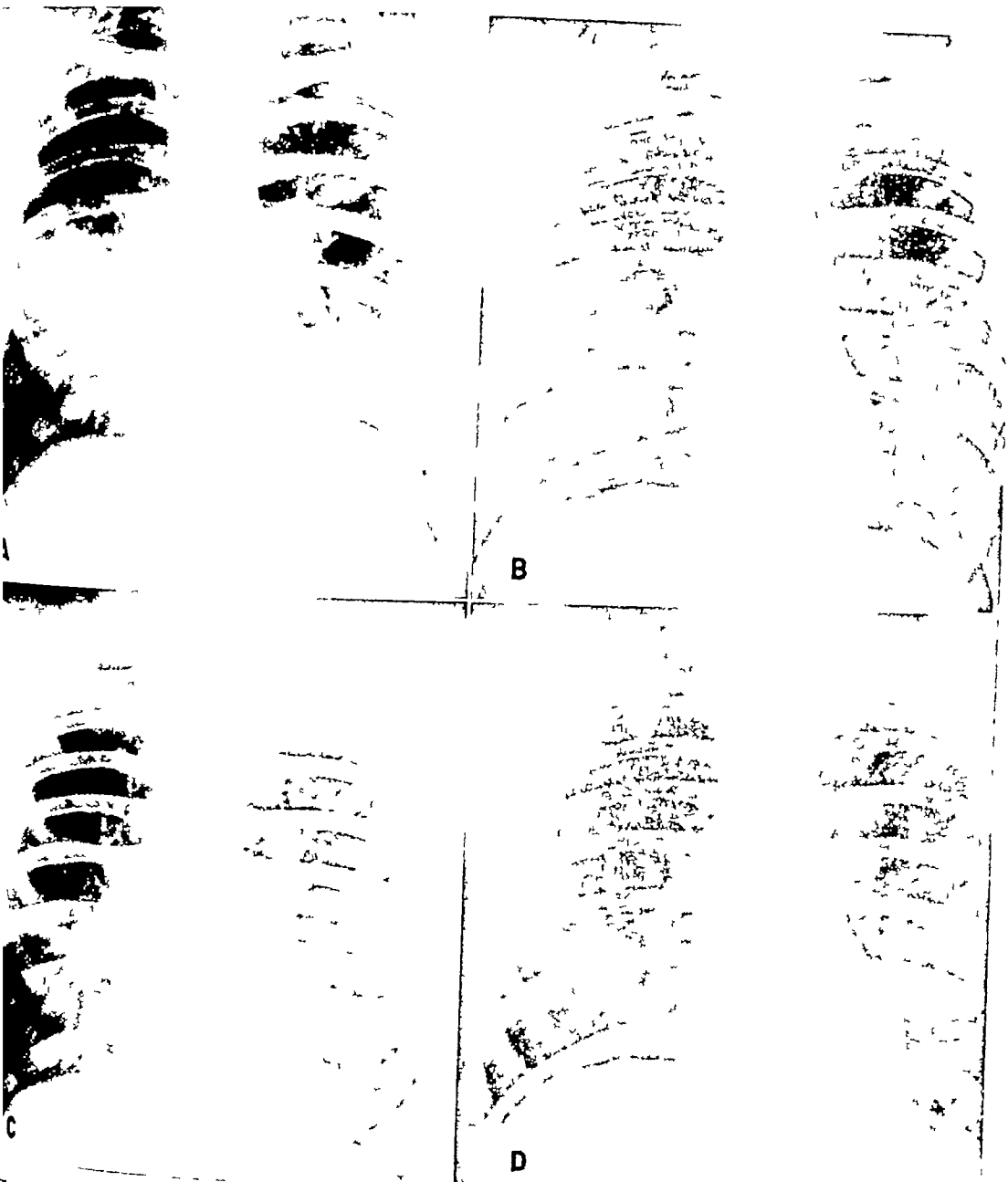


Fig. 6 Case 6 A At onset of pneumonia lesion in upper part of right lower lobe, with fairly large area of cavitation. B One month following onset primary cavity has disappeared and a second one has appeared slightly ventral to the first C Six weeks after onset almost complete resolution D Three months after onset lungs clear

...tle injection of the tracheobronchial tree, with a ...ll amount of mucopurulent exudate in both ...m bronchi, was noted At the same time lipiodol ...s instilled and a normal bronchial tree was ...onstrated The patient was discharged to duty, ...on June 6

Case 7 S S, 18 year old apprentice seaman, ...s admitted to the hospital on April 22, 1945, ...h a diagnosis of bronchopneumonia

...istory The past history was irrelevant except ...a cerebral concussion from an automobile accident in childhood For two days prior to admission, the patient had been hospitalized at a local naval dispensary because of fever, chills, dyspnea, dizziness, and slight stiffness of the neck He also had malaise, anorexia, one episode of vomiting, and a cough productive of mucopurulent sputum

Physical Examination The temperature on admission was 103 6° F, the pulse rate 100 per minute, and the respiratory rate 20 Pertinent physical findings were injection of the posterior pharynx and a few crepitant râles at the right base posteriorly

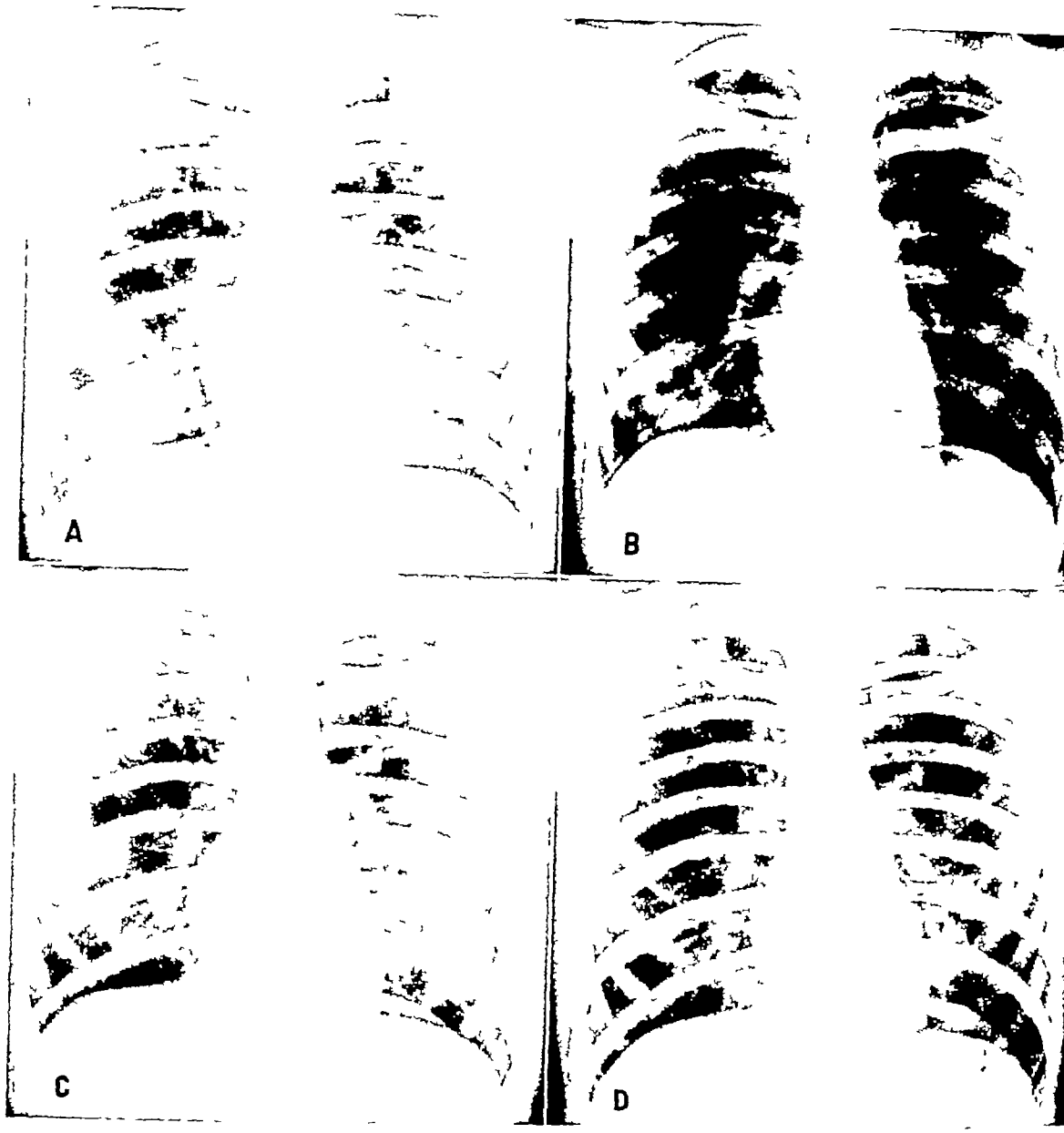


FIG 7 CASE 7 A At onset of pneumonia small lesion in right lower lobe B Nine days after onset large thin-walled area of cavitation in right lower lobe C Fourteen days after onset marked reduction in size of cavity D Thirty-seven days after onset lung clear

Laboratory Examinations The red blood cells numbered 5,230,000 per cubic millimeter, with 15 gm of hemoglobin The white blood count was 16,550 with 61 per cent segmented polymorphonuclear leukocytes, 22 per cent non-segmented polymorphonuclears, 15 per cent lymphocytes, 2 per cent monocytes The blood culture showed no growth, but culture of the sputum yielded a pure strain of B-hemolytic streptococcus Repeated smears and cultures were negative for tubercle bacilli

Roentgenogram of the Chest On April 22, a small area of pneumonic consolidation was seen immediately above the right dome of the diaphragm The remainder of both lung fields was clear

Course Penicillin therapy was immediately begun, with a dose of 15,000 units intramuscularly every three hours The temperature fell to 99° F overnight by crisis and remained normal thereafter On April 30, penicillin was discontinued, after a total of 1,100,000 units had been administered. At this time, the patient had been afebrile for three days but was still raising some clear mucoid sputum

On May 1, repeat roentgen examination of the chest revealed an oval cavity measuring 3 × 5 cm in the right lower lobe On May 16, there was a considerable reduction in the size of the cavity Further roentgen study on June 19 demonstrated almost complete disappearance of the lesion, with

only slight residual prominence of the bronchovascular trunk markings in the right lower lobe On July 7, there was complete clearing

On July 12, bronchoscopy was done and showed a normal tracheobronchial mucosa At the same time, lipiodol was instilled and a normal arborization pattern of the bronchial tree was demonstrated The patient was discharged to duty, well, on July 24

SUMMARY

1 The incidence, etiology, pathology, and clinical features of necrosuppurative bronchopneumonia are described, and the clinical varieties are noted

2 The typical roentgen characteristics are presented Cavitation within an area of pneumonia is pathognomonic of this form of pneumonia However, atelectasis and emphysema in an area of pneumonitis and slow resolution should also suggest that the pneumonia is of the suppurative type

3 A brief review of the complications, differential diagnosis and treatment is appended

4 Seven cases are reported in some detail

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SUMARIO

Bronconeumonía Supurada con Cavitación

Entre 3,500 casos de neumonía observados en un hospital naval, encontráronse 7 de bronconeumonía caracterizada por supuración parenquimática y esfacelo con

formación de cavernas Las características clínicas comprendieron tos, fiebre, esputo purulento y dolor pleurítico Los signos físicos y los hallazgos de laboratorio no fueron típicos

Reconócense cuatro grupos clínicos de la enfermedad mencionada (1) casos que parecen de bronconeumonía ordinaria salvo por el cuadro roentgenológico de cavernas, (2) casos más graves y prolongados, con tendencia a la propagación a nuevos segmentos broncopulmonares, (3) casos complicados con absceso pulmonar aerobio o invasión pleural con empiema o pioneumotórax, y (4) casos con difusión general o regional

La característica radiográfica cardinal consiste en la presencia de una o más zonas de cavitación en una zona de hepatización neumónica Las cavernas pueden disminuir de tamaño y desaparecer o agrandar rápidamente en presencia de resolución de la infiltración neumónica circundante

Las formas simples de la enfermedad suelen resolverse espontáneamente Las complicaciones pueden exigir la intervención cruenta En la pequeña serie comunicada, la penicilina pareció ser de valor

Sumarízanse las siete historias clínicas En todas se despejaron los pulmones, y en ningún caso se necesitó la cirugía

Roentgen Findings in Functional Disturbances of the Gastro-Intestinal Tract[1]

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FUNCTIONAL derangement of the gastro-intestinal tract has recently received more attention from the radiologist Reviewing the literature and looking back on the experience of recent years, one is struck by the way in which this emphasis has varied In the early days of the use of the barium meal, the functional and the organic abnormalities were probably considered of equal importance Indeed, the changes in function were sometimes used as indirect evidence of a lesion, even though definite organic change could not be demonstrated The pendulum seemed to swing toward the other extreme for a time, and one gained the impression that the various functional disorders were being, for the most part, ignored in gastro-intestinal diagnosis Now, however, we appear to be approaching a more neutral position and function is again being stressed We therefore propose to review some of the highlights in the physiology of the gastro-intestinal tract that should be of interest to the roentgenologist in his routine work Then, considering each segment of the alimentary canal, we will attempt, when possible, to correlate functional derangements with organic pathologic processes

ESOPHAGUS

Normal Physiology Normal deglutition is dependent upon the combined, co-ordinated efforts of the pharynx and esophagus The initial phase is voluntary, with the tongue carrying a food bolus into the pharynx Almost immediately the pharynx and larynx are elevated, the upper passages close off, and the pharyngeal musculature contracts, driving the bolus past a relaxed cricopharyngeal ring into the esophagus Here the muscular activity continues as the primary peristaltic wave Although the exact pharyngeal mechanism is still debated, it certainly comprises a set of closely co-ordinated involuntary reflex acts that end in the primary peristaltic wave which, together with gravity, acts as the downward propelling force During quiet respiration, the esophageal opening is closed off, presumably by the tonic contraction of the cricopharyngeus muscles

Three types of muscular activity occur in the esophagus The primary waves originate with the pharyngeal contraction Secondary waves are thought to result from local mechanical stimulation and are also seen in obstructive lesions of the lower esophagus They act as true peristaltic waves and will travel in both directions During sustained inspiration, peristaltic waves may terminate in the so-called phrenic ampulla—actually a ballooning out of the terminal esophagus with a narrow contraction ring just above (Fig 1, A) If inspiration is prolonged, material in the ampulla will regurgitate for a short distance The anatomical basis for the narrowing is not well established, but a pinchcock action of the diaphragm during deep inspiration may perhaps account for the apparently normal ampulla formation The so-called tertiary contractions occur most frequently in patients past middle age They appear to be simultaneous contraction rings, varying in degree and frequency but giving the esophagus a peculiar serrated appearance They are usually momentary, disappearing almost as rapidly as they appear The contractions may be so marked as to give the esophagus a "corkscrew" appearance Beading and temporary multiple diverticula-like pock-

[1] Read, by invitation, at the Annual Meeting of the Medical Society of New Jersey, April 23, 1947 Accepted for publication in June 1947

ets may occur "Curling" is another descriptive term given to these tertiary contractions (Fig 1) Schatzki (12), at one time, suspected paraesophageal adhesions as the underlying cause Others believe there is a disturbance in innervation or actual bulging of weakened portions of the esophageal wall The condition is almost entirely asymptomatic, and Templeton (13) believes it to be relatively insignificant

exact innervation has not been worke out, but the autonomic nervous syste seems to play an active role Interestingl enough, dissolution and marked atrophy o the normal intramural collections of gan glion cells have been reported in histologi material obtained from autopsies in case of achalasia (10)

Pathologic Physiology The radiologist i often called upon to differentiate difficult

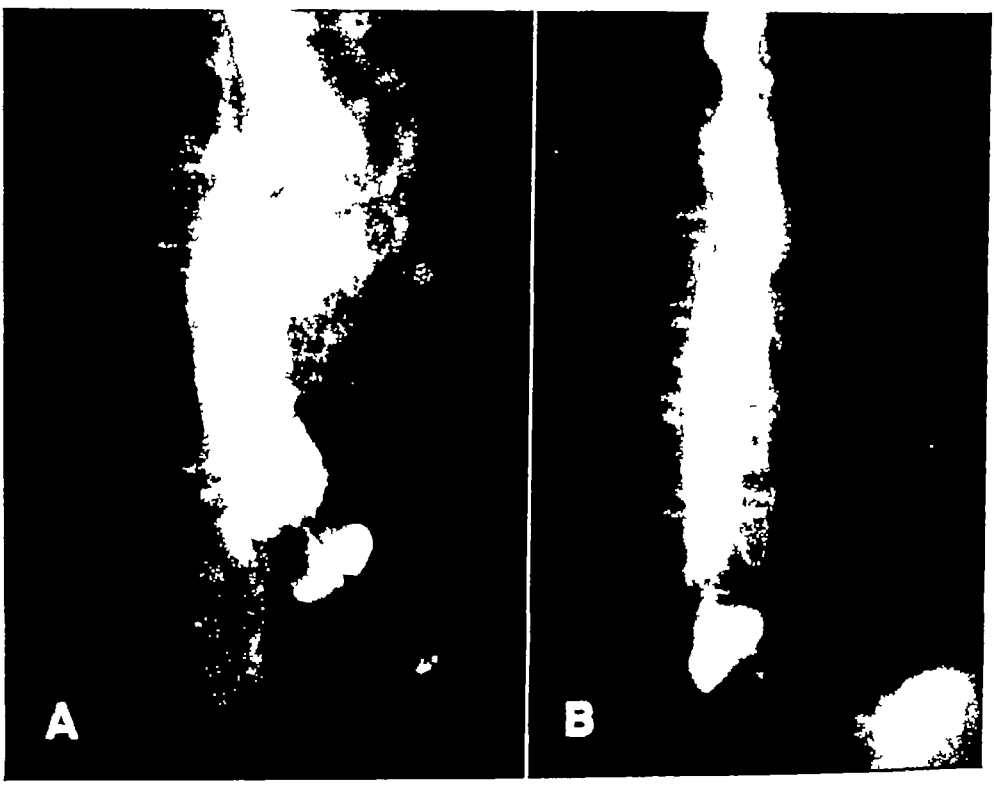

Fig 1 A Barium-filled esophagus showing phrenic ampulla and curling phenomenon
B Same esophagus a moment later The "curling" pattern has disappeared

The problem of the cardiac sphincter has caused some controversy Anatomically a thickened muscular ring does not exist but, physiologically, active sphincteric action is present The tonic muscular contraction of the esophagus at the cardia is quite likely an expression of gastric tone and probably parallels it A pinchcock action of the diaphragm at the hiatus may be partly responsible, however, fluoroscopy of patients with a hiatus hernia will usually demonstrate active and competent sphincteric action with the support of the diaphragm lacking The

in swallowing caused by a central neurologic lesion from that due to a local cause Inflammation, neoplasm, and obstruction due to a foreign body are the chief organic lesions to be ruled out These being absent, we can conclude that the difficulty in starting the act of deglutition probably has its origin in the central nervous system, or in some primary myopathy

If and when the normal co-ordinated mechanism of deglutition is upset, pharyngeal diverticula may result (Fig 2) These are little outpouchings at the site where the constrictor muscles leave a weak spot

in the posterior wall of the esophageal introitus The diverticulum may just be beginning to show when one sees a patient with some vague difficulty in swallowing When these diverticula become large they cease to fall into the realm of the functional and become organic lesions, which usually require surgical repair

We are not convinced that the secondary peristalsis described above is purely an expression of normal function, since we have often seen something of this nature in cases of minor obstruction Areas of spasm may be observed associated with the trauma of a foreign body, where a rather diffuse wave begins at the site of the lesion, spreading out both caudad and cephalad, to give a diffuse narrowing not unlike that described by others as secondary peristalsis We have also seen this in what was thought to be a subacute or acute esophagitis and in areas where a foreign body has apparently scratched or actually lodged in the wall of the esophagus, with resultant spasm

Whether or not there actually is a sphincter which fails to relax in achalasia, bears some discussion The fact that no long-standing areas of spasm occur at any other spot than the lower end argues in favor of its presence We have, furthermore, seen cardiospasm occur in the short-esophagus type of diaphragmatic hernia, where the pinch-cock action of the diaphragm could not possibly have been the mechanism producing the obstruction It is our opinion that minor degrees of cardiospasm occur more often than is thought, being too transient to cause any continued dilatation or symptomatology

In the marked irritability accompanying esophagitis, it has been our impression that the curling phenomenon is apparently increased Indeed, we have come to the conclusion that the presence of curling as described by Schatzki and others is definitely a pathologic finding and rarely occurs without some superimposed irritability of the esophagus, for in our experience it is not outstanding unless there is an underlying pathologic process

Fig 2 Film of the upper esophagus showing a small pharyngeal diverticulum, non obstructing

STOMACH

Normal Physiology The empty stomach is tonically contracted and exhibits periods of muscular activity called "hunger contractions" The gastric wall is capable of considerable tonal change allowing for active accommodation to varying food volumes Peristaltic waves, on the average of three per minute, start as shallow ripples near the cardia, grow deeper and stronger as they advance, and run through the antrum to the pylorus or end in what appears to be a systolic contraction of the antrum The antrum has been observed contracting rhythmically with the duodenum Alvarez (1) suggests the presence of gastric pacemakers, one in the gastric wall near the cardia, the other on the proximal side of the pyloric antrum

The modern tendency in the problem of gastric emptying is to minimize the importance of a pyloric sphincter and to stress variations in intragastric pressure subsequent to general tonus changes in the gastric wall Fat in the duodenum inhibits gastric activity through the humoral

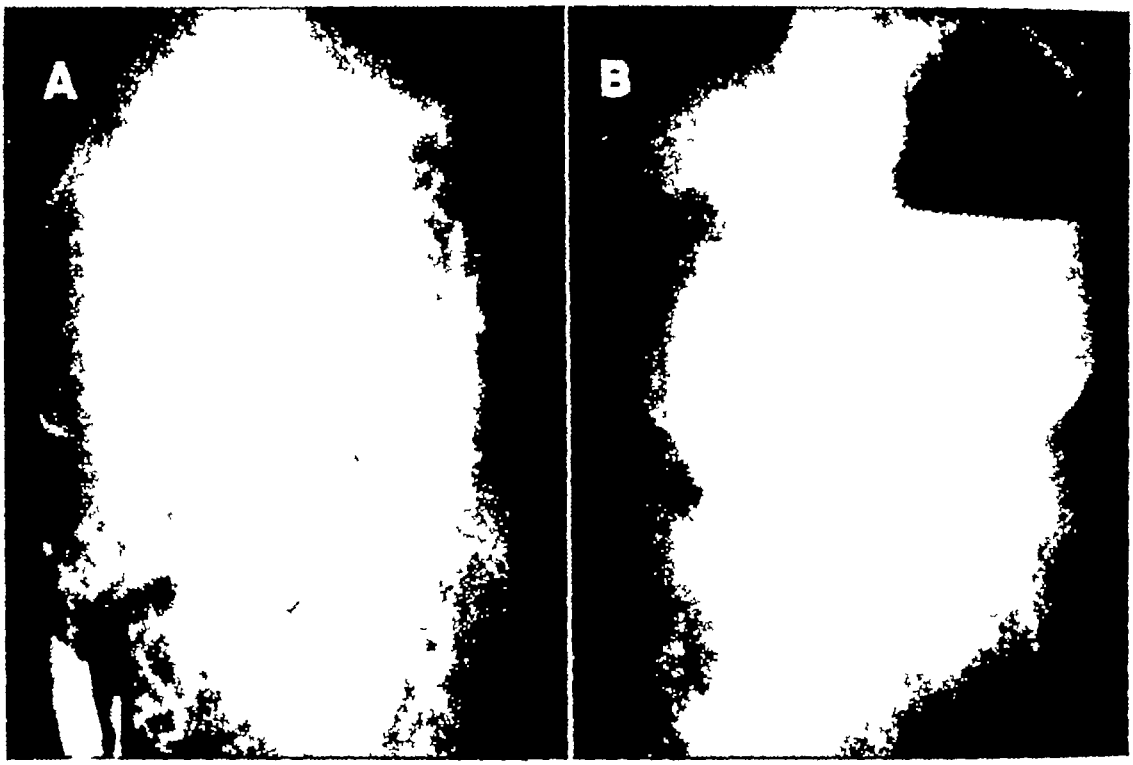

Fig 3 A The barium-filled stomach and upper intestines of a cat, one hour and forty-five minutes after the ingestion of a barium and water mixture under average normal conditions B Same stomach after a dose of ephedrine Note dilatation, relaxation and atonicity, with ' apparent pylorospasm " The time interval is the same Over-stimulation of the sympathetics has caused a marked delay in emptying time

medium of enterogastrone, a hormone-like substance produced in the duodenal wall Acids and other irritating substances in the duodenum inhibit gastric motility reflexly through the vagus Distention of the duodenum with chyme has the same effect, and there appears to be a definite balance between intragastric and intraduodenal pressures Foods in fluid state pass rapidly through the pylorus, solids are held back until properly macerated Stimuli from within the gastric lumen seem to have some regulatory effect upon the tone of both the pyloric antrum and the sphincter The vagus and sympathetic innervation is a regulatory mechanism, the first predominating Sympathetic stimulation is mainly inhibitory, while vagus stimulation increases gastric activity, thus actually a mixture of responses may occur Vagotomy in man is followed by a period of depressed motor activity and muscular hypotonicity, later the peripheral intrinsic mechanism "takes over," giving almost normal function, with perhaps some delay in the initial emptying time

Pathologic Physiology The subject of antral spasm and pylorospasm in the presence of local, adjacent, or distant disease is one that has provoked much discussion It is perhaps the most frequently observed alteration in the gastro-intestinal motility gradient Templeton does not believe there is sufficient experimental or clinical evidence to prove the presence of so-called "reflex pylorospasm" from other intra-abdominal diseases He found no increased incidence of pylorospasm in patients with evidence of biliary, appendiceal, or renal disease Since delayed emptying not caused by a local organic lesion appears to be an expression of gastric hypomotility and hypotonicity, it sometimes gives rise to a roentgen picture which suggests that the pylorus is in spasm, although it may actually not be so We are inclined to agree with Templeton on the basis of the evidence he presents and on the basis of

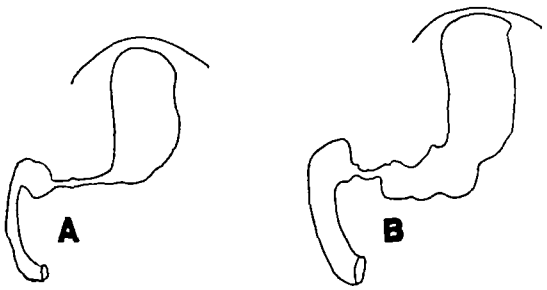

Fig 4 A Small antral ulcer producing diffuse antral spasm B Same stomach after three weeks of dietary regime The antral spasm has for the most part relaxed An associated neoplasm was suspected at the first examination (Tracings of x ray films)

(Figs 4 and 5) At first sight, however, we are often confronted by a stubborn and difficult problem when attempting to rule out neoplasm in this region

Earlier in the history of the use of the barium meal, there were some observers, notably Carman, who would ascribe the various functional abnormalities to a definite underlying local cause Observations prove this an unreliable deduction The error has been that diagnoses of peptic ulcer were made when there was no obvious local lesion The diagnoses were made on

Fig 5 Stomach films showing an antral spasm associated with an ulcer on the lesser curvature and one in the duodenum as well The films show various phases of contraction and relaxation

some unpublished experimental evidence of our own Nevertheless, it is this appearance, whatever the cause may be, that all of us have been calling "pylorospasm" (Fig 3) This picture is often seen apparently secondary to gallbladder disease and other remote intra-abdominal causes producing six-hour retention A twenty-four-hour barium meal retention rarely, if ever, occurs

If an ulcer is found in the first part of the duodenum or in the actual pyloric channel, true pylorospasm is very common With actual local ulcerative antral gastritis, as described by Golden (7) the secondary nature of the antral spasm and pylorospasm is actually proved by a change following conservative treatment the basis of secondary signs only, even when a crater could not be seen Moreover, emphasis was laid on the reflex effect of distant lesions on the stomach Carman (5), for example, listed ten probable causes for what he called gastrospasm and spoke of the primary and secondary functional diagnostic findings He stressed the indirect signs of duodenal ulcer, namely, the alterations in tone, peristalsis, and motility of the stomach We now know that the functional irregularities, though not to be disregarded, should be considered due to local disease only when a definite organic lesion can be shown

Emotional states can bring on exactly the same findings In this regard, it is of interest to watch an apparent "pyloro-

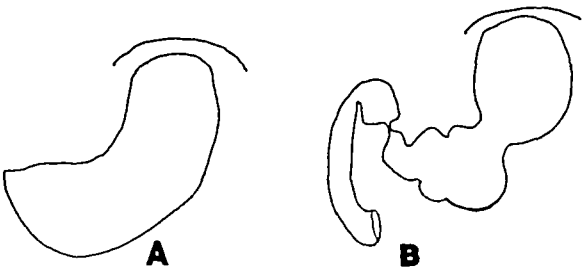

Fig 6 A Tracing of a stomach immediately after administration of barium, showing "apparent pylorospasm" B Same stomach a few moments later after discussion of food with the patient

spasm" relax and the stomach regain its tone and activity under the fluoroscope when one mentions food to a patient (Fig 6) This change will occur in an otherwise orthotonic stomach which seems to have rebelled at the intrusion of anything as unsavory and unpalatable as a barium and water mixture The autonomic control of the stomach activity had probably been affected either through the sympathetics or the vagus or both

DUODENUM

Normal Physiology Duodenal movements are varied and independent of the stomach X-ray observation reveals considerable duodenal activity The duodenal bulb may remain distended at intervals or contract immediately and empty Sometimes normal individuals show apparent irritability and the bulb fills but partially This is followed, after a short rest, by a more normal activity with decreased duodenal tonus Peristaltic waves and sleeve-like contractions may affect the cap in a rhythmic manner or indeed involve the entire duodenum Many contraction waves die out in the lower part of the descending limb or near the beginning of the ascending limb When this occurs, the barium column just ahead will partially regurgitate, but this is not a true antiperistalsis Apparently, the portion of the duodenal wall in relation with the superior mesenteric artery fails to relax completely with the oncoming peristaltic wave and produces a more or less normal physiologic obstruction Investigators have felt that the superior mesenteric artery causes an actual organic obstruction (6) However, an indentation of the duodenal loop is almost never demonstrated Once barium passes this point, be it a point of pressure or a hypertonic focus, it readily continues on to the jejunum Sometimes the regurgitated barium will balloon out the duodenal cap or pass through a relaxed pylorus into the stomach On occasion, true antiperistalsis is seen in the normal duodenum

Pathologic Physiology Most of us are familiar with the disturbed duodenal physiology which occurs with or without anorexia nervosa Only now and again do we see this condition associated with definite organic abnormality A true anorexia nervosa may often lead to such a marked degree of voluntary starvation that a vicious cycle develops, that is to say, the loss of weight may allow an increased drag of the mesenteric root and its vessels over the distal portion of the duodenum and thereby produce an actual organic obstruction In such a case, reverse peristalsis, which is a normal finding in the duodenum, may become increased and result in stasis and shuttling of the barium back and forth within the duodenal loop

JEJUNUM AND ILEUM

Normal Physiology The normal movements of the small bowel mix the chyme with digestive juices, facilitate absorption, and force the unwanted remnants into the large bowel In general, there are two types of activity One is essentially myogenic, appearing as constantly changing rhythmic segmental contractions These have a mixing and kneading effect, but there is no real displacement of the intestinal contents The so-called pendular movements affecting larger segments are a variant of this myogenic activity Secondly, there are peristaltic waves which are dependent on the integrity of the myenteric plexus, through which the waves are co-ordinated Bayliss and Starling (3) in their original work described peristalsis as a wave of contraction preceded by a wave of inhibition In more recent years, Raiford and Mulinos (11) recorded con-

FIG 7 A Stomach of a patient with a diffuse inflammatory process in the wall, showing little other than diffuse thickening of the mucosal contours B Barium-filled small bowel (mid portion) At operation only the mesentery was involved There are delayed motility and moderate dilatation C Barium in the lower small bowel after having passed through the abnormal portion in B The caliber of the bowel is normal

tractions of the circular and longitudinal muscles of the exteriorized colon of the dog They found that "stimuli" applied to the mucosa are followed by contractions of the longitudinal muscle at and below the stimulus, and by contraction of the circular muscle above Atropine and cocaine will abolish peristalsis while myogenic contractions continue Dilatation is a part of the myenteric reflex and is not due to inhibition Whatever the mechanisms, they are most certainly inherent in the gut wall and not dependent upon an extrinsic nervous mechanism

Alvarez's (1) gradient theory is interesting and offers a way of explaining the apparent inherent polarity of the small bowel He suggests there are downward gradations in all forms of physiologic activity in the bowel wall from the duodenum to the ileocecal junction, and that these gradations are responsible for the orderly progress of digestion Influences altering or reversing the gradient result in abnormal function and subjective symptoms

The extrinsic nervous mechanism consisting of vagal and sympathetic innervations seems to have a regulatory effect For the most part, vagal stimulation results in increased muscular tone and activity, which is expressed through Auerbach's myenteric plexus The sympathetic is mainly inhibitory as far as the main muscular tunic is concerned Stimulation of Meissner's submucous plexus through the sympathetic fibers results in active secretion of mucus and vigorous contractions of groups of intestinal villi

The chemical mediator theory helps to explain the effects of nerve stimulation An epinephrine-like substance liberated at the endings of the sympathetics has excitatory as well as inhibitory components Acetylcholine seems to be the excitor substance liberated at the parasympathetic endings It is deactivated by specific and non-specific tissue esterases The relative amounts of the mediator substances produced during any one period due to reflex or central nervous system influences may account for the many variations which seem to exist in so-called "normal activity" Bargen (2) in a recent paper says it seems futile to designate a so-called normal for the transit time of intestinal contents The transit time of the small intestines in one apparently normal person may be less than an hour while in another it is as much as five hours It is, therefore, probably advisable to speak in terms of average transit time and a broad zone of normal Bargen suggests that a particularly fruitful field for research exists in the nervous control of the intestines It is interesting to note that vagotomy and splanchnicectomy have little lasting effect on the digestive functions in man (1)

The ileocecal sphincter permits interval

Fig 8 A Normal small bowel pattern, one hour after ingestion of barium meal

passage of intestinal contents and hinders reflux into the ileum An actual thickening of the circular muscle fibers forms a sphincter guard for the orifice Observations in man reveal that during digestion the sphincter opens rhythmically During emotional excitement or subsequent to the act of swallowing, the frequency of the openings increases The increased muscular activity at the sphincter during digestion possibly helps to explain why barium enemas frequently fail to show a reflux into the ileum in patients who have had breakfast on the morning of the examination We therefore make it mandatory for the patient to omit breakfast, particularly when we are interested in the terminal ileum

Pathologic Physiology Various disturbances in the motility gradient of the small intestine are seen in extra-alimentary tract disease The patient with reflex motor disturbances of the stomach may also show a hypermotility and/or multiple spastic areas in the gut Retroperitoneal pathology may cause various degrees of reflex ileus Spastic manifestations result from mesenteric disease, such as calcifying mesenteric nodes and from less chronic processes (Fig 7)

Fig 8 B Small bowel shown in Fig 8, A, at same time interval, showing so-called milk reaction " Note multiple spastic areas and segmentation

C Same small bowel at same interval after withdrawal of the milk allergen

There is usually a functional derange-

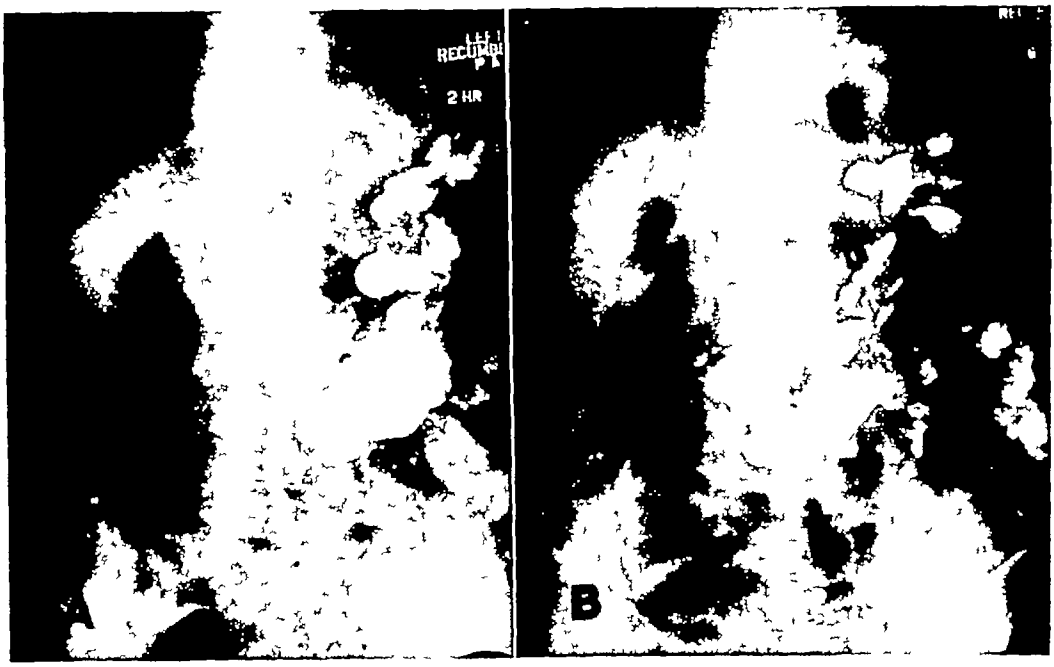

FIG 9 A Small bowel film showing marked hypomotility, clumping, and smoothing of the mucosal folds in a case of hypoproteinemia with edema of the bowel wall (two hour film) B Six-hour film showing little further progress of the barium in four hours Barium in the large bowel is residual from previous barium enema

ment of the small gut when the mesentery is involved by a neoplasm The bowel pattern may be unusually abnormal in such a case without any actual organic change taking place Lymphosarcoma may cause such a disturbed intestinal pattern Spasm, segmentation, and disturbed motility result Other lesions in the mesentery have been shown to be responsible for the same type of change, however, the only difference being that there was not such a large area of involvement Carcinoma spreading from elsewhere in the gut and certain benign tumors which ostensibly block the lymphatics or affect the nerve supply to the bowel can also be responsible Golden (8) quotes Vespignani as showing similar changes in what he described as sclerosing mesenteritis

Psychic functional disturbances may often be confused with organic processes All sorts of gastrocolic, gastroenteric, and enterocolic reflexes may result Golden cites the effect of fright on the small bowel pattern of laboratory animals He shows some interesting patterns, both before and after such an effect was produced (8)

Food allergy, sensitivity, or idiosyncrasy may produce striking changes in motility and pattern In its early stages hypermotility without any change in the bowel pattern is the usual finding, but later in the disease more marked changes in motility and pattern supervene There often is a gastric retention accompanying hypermotility of the bowel Segmentation and hypomotility may be a still later manifestation (Fig 8, A, B, C)

The patterns of abnormal nutrition (deficiency or irritation pattern) (Fig 9) may at first be purely functional Organic changes are, as Golden and others have shown, a late manifestation (Fig 9)

So-called acute non-specific catarrhal enteritis will at times show definite small bowel functional disturbances which in a severe stage might be confused with organic disease (Fig 10)

COLON

Normal Physiology The movements of the colon, though varied, do bear similarity to those seen in the small bowel, but there are longer periods of relative inactivity

Fig 10 A gastro intestinal film showing a simultaneous filling of the stomach, small bowel, and proximal colon in a patient with extreme hypermotility (one-hour film) The patient was suffering from an acute gastro enteritis following apparent 'food poisoning" He had eaten some shellfish the previous day, to which he considered himself sensitive

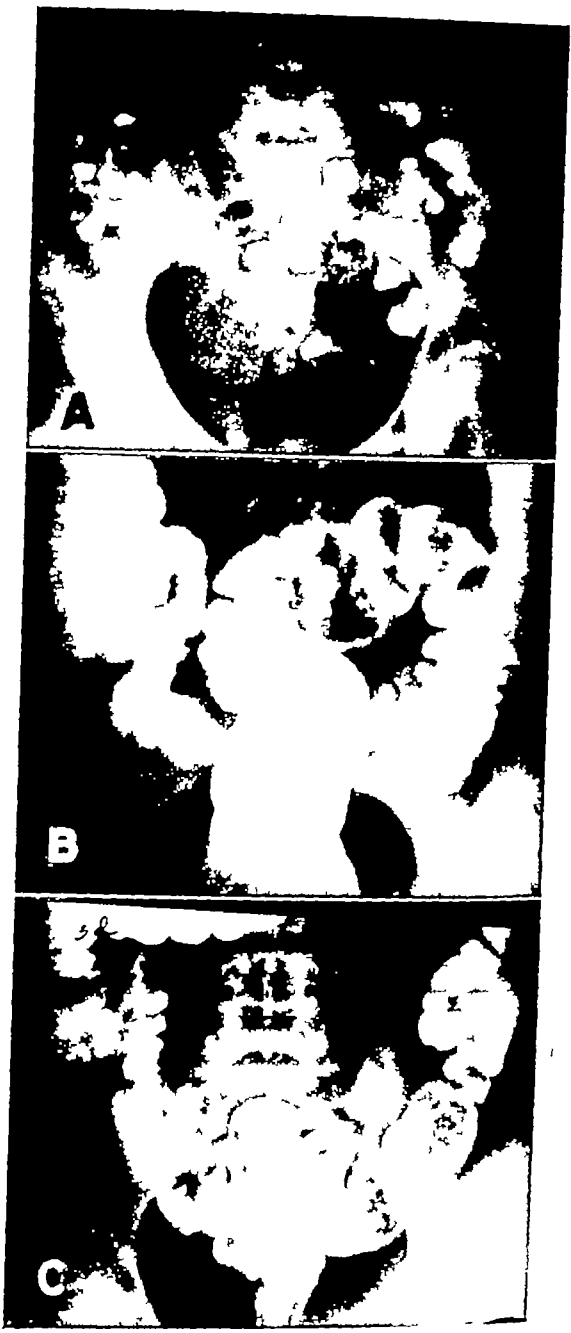

Fig 11 A Scybala shown in the gas filled rectum in a patient with severe constipation B Barium enema showing fecal masses in an atonic dilated sigmoid C Same case as B, post evacuation In spite of the stimulus of distention by the enema, there are still scybala in both sigmoid and rectum

Haustral formation seems to be dependent upon contractions of the muscularis mucosae and shortening of the taeniae coli The slow but constantly changing haustrations have a mixing and kneading effect upon colonic contents Mass movements of the large bowel usually occur several times a day and most frequently are stimulated through the mechanism of the gastrocolic reflex set off by food entering the stomach The taste, smell, or thought of food, disturbing emotions, and other psychic stimuli may reflexly initiate the movements The rushes, usually beginning near the hepatic flexure, carry the fecal contents all the way to the pelvic colon The descending colon is relatively empty except during the mass movements

Defecation is the final purpose of the large bowel The rectum is normally empty except during and prior to defecation The defecation reflex occurs when intrarectal pressures reach 40 to 50 mm of mercury (4) Fecal material may pass the narrowed rectosigmoid junction at the tail end of a mass movement or there may be just a plain overflow from the pelvic colon Thereafter strong peristaltic waves are accompanied by contraction of the abdominal musculature and the diaphragm, and

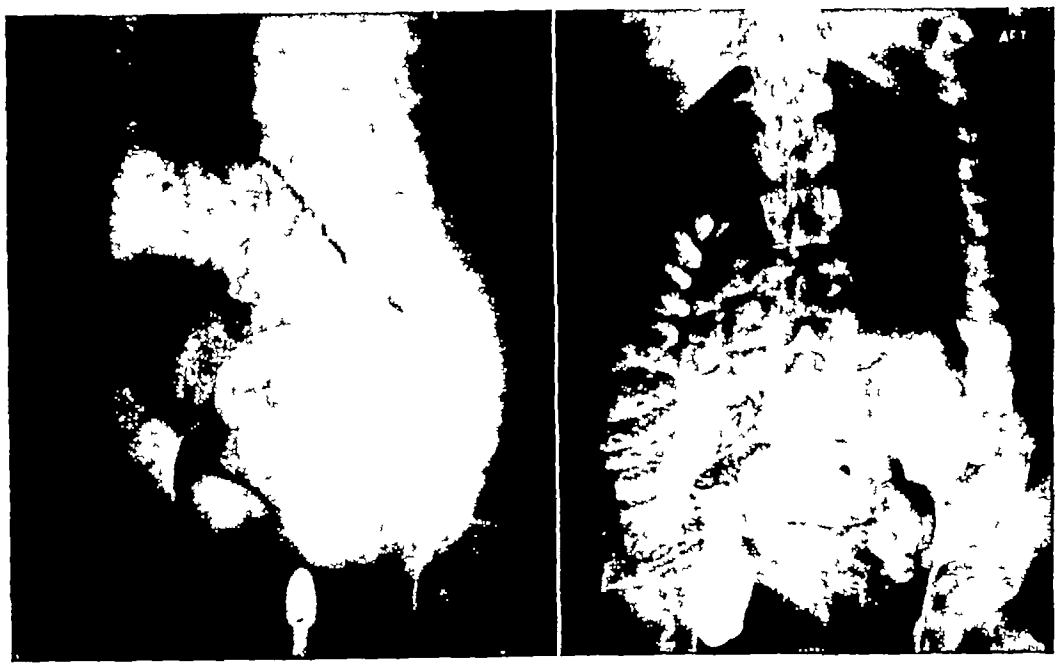

Fig 12 Markedly atonic colon before and after evacuation of barium enema The patient was a cathartic addict

lastly by a co-ordinate relaxation of the anal sphincters The pressure stimuli can be voluntarily suppressed, the rectum becoming unresponsive after it adjusts its capacity to a fecal bulk Such seems the beginning of the constipated bowel (Fig 11)

Both spinal and autonomic nerves supply the colon The effects of the vegetative system are in the main inhibitory The vagus gives branches to the proximal half of the colon and the sacral parasympathetics supply the remainder Stimulation of the latter results in contractions of the bowel wall and relaxation of the anal sphincters The profound effects of psychic stimuli through a vagus component are fairly well established The results of sympathectomy for megacolon have been disappointing It is interesting to note that atrophy and dissolution of the plexuses of Meissner and Auerbach have been observed in megacolon, while hypertrophic changes have been reported in advanced ulcerative colitis (2) It is apparent that many aspects of intestinal neurophysiology and the resultant functional counterparts have not been clearly worked out

Pathologic Physiology The purely functional manifestations of the gastro-intestinal tract were perhaps first noted in the colon Here the various psychic and reflex functional changes often give rise to the so-called irritable colon or mucous colitis The so-called "string sign" was one of the earliest specific signs described in studies of the large bowel Anyone who has done a number of barium enema studies will appreciate how easily the function of the large bowel is upset without ever proving any organic change All gradations from marked atonicity and dilatation to a severe diffuse spasm can be seen (Figs 12 and 13) Certain long-standing functional changes may be the result of voluntary change in bowel habits and/or certain congenital anomalies The cathartic addict with the sluggish bowel may have his trouble precipitated by various minor congenital anomalies such as abnormal length, attachment, or rotation These may have been the precipitating factors in the long history of cathartic use Any evidence of scybala in the rectum will tell us that there is a disturbance in the usual motility of the colon Normally the rectum must never contain

Fig 13 Colon film showing spastic areas in the ascending and descending colon A long string sign" is shown in the transverse colon

any fecal material except during the act of defecation

The pattern of the colon after excessive use of cathartics, as recently described by Heilbrun (9) and Golden (8), seems to deserve some comments, since this picture can simulate organic change but is for the most part reversible We think it should be considered in the realm of functional disease, particularly since withdrawal of the cathartic will again bring about a relatively normal pattern

CONCLUSIONS

From the foregoing discussion, it is evident that the autonomic control of the digestive tract is a complicated mechanism Experimental studies as well as certain clinical evidence show that the alimentary tube has an inherent mechanism of its own which, if allowed to function by itself, under ordinary conditions, will carry on as an autonomous unit Certain writers, as Alvarez and Bargen, however, point out that the regulatory effect of the autonomic nervous system is called into action when and if there is a necessity for an added control to modify and correlate this inherent mechanism Then, and only then, does it become an important factor in the function of the alimentary tube If we are to accept the chemical mediator theory as the most likely controlling mechanism of tone and contraction and relaxation of smooth musculature, then it is quite evident that this secondary role of the autonomic nervous system may take a prominent part in functional abnormalities of the entire tract or any portion thereof

We have attempted to show how the roentgen patterns may be altered in the case of various disturbances of body functions both alimentary and extra-alimentary The radiologist can find much of interest both organically and functionally in the mirror of the gastro-intestinal tract, which so often reflects the general health of the individual

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SUMARIO

Hallazgos Roentgenológicos en los Trastornos Funcionales del Tubo Digestivo

Repásanse los puntos culminantes de la fisiología del tubo digestivo que interesan al roentgenólogo, tratando de correlacionar los desarreglos funcionales de cada segmento con los procesos patológicos orgánicos

Esófago En el esófago existen tres formas de actividad muscular las ondas peristálticas primarias, las ondas secundarias debidas a excitación mecánica local y las contracciones terciarias denominadas a veces "rizos" Las ondas secundarias se observan cuando hay pequeñas obstrucciones y asociadas a traumatismo por cuerpos extraños Los "rizos" pasan por ser debidos a irritación imputable a un proceso patológico subyacente A falta de inflamación, neoplasia u obstrucción por cuerpo extraño, las disfagias tienen probablemente su origen en el sistema nervioso central o en alguna miopatía primaria

Estómago El "piloroespasmo aparente" puede ser secundario a colecistopatía o tener por causa estados afectivos El verdadero piloroespasmo es frecuente en la úlcera duodenal o pilórica o la gastritis ulcerada, pero no está justificado un diagnóstico de úlcera a base exclusiva de irregularidades funcionales Estas sólo deben ser consideradas como debidas a afección local cuando existe una lesión orgánica bien definida

Duodeno Los trastornos de la fisiología duodenal rara vez van asociados con una anomalía orgánica bien definida Sin embargo, una verdadera anorexia nerviosa puede, por la pérdida de peso, con la mayor tracción ejercida sobre la raíz del mesenterio y sus vasos, culminar en obstrucción orgánica real, acentuando el antiperistaltismo observado normalmente en el duodeno y con éstasis real

Yeyuno e Ileon Los trastornos motores reflejos del estómago, las mesenteropatías y las lesiones retroperitoneales, así como los estados emotivos, las perturbaciones alérgicas y las deficiencias nutritivas, pueden ocasionar trastornos funcionales del intestino delgado

Colon Las alteraciones funcionales psíquicas y reflejas dan a menudo origen a la llamada irritación colónica o colitis mucosa El prolongado empleo de catárticos puede provocar un cuadro que simula enfermedad orgánica pero que en su mayor parte es reversible

Llégase por fin a la conclusión de que el tubo digestivo tiene un mecanismo inherente propio, que si se deja funcionar por su cuenta en las condiciones ordinarias, trabajará como unidad autónoma No obstante, el papel del sistema nervioso autónomo puede convertirse en un factor importante y desempeñar una misión significativa en las anomalías funcionales de todo el tubo o de parte del mismo

External Irradiation with Roentgen Rays and Radium in the Treatment of Human Leukemias, Lymphomas, and Allied Disorders of the Hemopoietic System[1]

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ROENTGEN THERAPY has its established place as a valuable palliative procedure in the treatment of human leukemias, lymphomas, and allied diseases

Its general and local effects in these disorders have been the subject of numerous reports by expert radiologists and hematologists In the last decade radioactive isotopes and recently the nitrogen mustards have been added to the therapeutic arsenal against these diseases The purpose of this presentation is to furnish an introduction to the papers[2] on treatment with these new methods rather than to contribute anything new As a basis for comparison with the results, complications, advantages, and limitations of the therapeutic use of these new compounds, we have reviewed 337 cases of blood dyscrasias treated by external irradiation in Billings Hospital (University of Chicago)

MATERIAL

The 337 cases represent the number of patients accepted for irradiation therapy from 1929 to 1945 The total number of patients with blood diseases seen in the clinics and in the hospital during that period could not be determined

The series consists of patients with leukemia, Hodgkin's disease, lymphosarcoma, and polycythemia rubra vera The small number of patients with polycythemia rubra is included because in this group strides forward with the new agents have been made In all cases of Hodgkin's disease and lymphosarcoma the diagnosis was verified by biopsy In 33 per cent of leukemias confirmation was obtained by bone marrow aspiration or biopsy, lymph-node biopsy, or autopsy

Table I shows the number of cases in each group and some pertinent data The distribution of the diagnoses is similar to that reported by Craver for the lymphoblastomas seen at Memorial Hospital, New York (3) The most frequently treated condition in both instances was Hodgkin's disease We were able to keep track of the largest number of patients, relatively, in the leukemia group

THERAPY

The routine treatment in all four groups of disease was roentgen therapy given as local irradiation Table II indicates the limited use of total body or wide-field spray irradiation, radium therapy, and chemical agents supporting or replacing roentgen irradiation The chemicals were Fowler's solution in myelogenous leukemia, used systematically over long periods, radioactive phosphorus in polycythemia rubra, and nitrogen mustards in selected cases of all groups

Radical excision of a localized enlarged lymph node, which was the only sign of the disease, was performed in a single case of Hodgkin's disease Supportive treatment with blood transfusions, iron, vitamins, adequate diet, plenty of rest, exposure to fresh air and sunshine, was used on a large scale and found to be of great importance in all groups

The roentgen ray quality used by us for the treatment of these conditions is h v l 1 5 mm Cu (200 kv , 1 0 mm Cu plus 1 0 mm Al filter) Only for the treatment

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[1] From the Division of Roentgenology, Department of Medicine, The University of Chicago Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill , Dec 1–6, 1946

[2] One of these papers, by Spurr, Jacobson, and Taylor follows (page 387)

TABLE I SUMMARY OF 337 CASES OF DISEASE OF THE HEMOPOIETIC SYSTEM TREATED BY ROENTGEN THERAPY 1929–1945

Diagnosis	Number Irradiated Cases	Sex M	Sex F	Age Range and Average Age (years)	Duration Before Treatment (months)	Cases Followed
LEUKEMIA	110	62	48	1–85		81
Chronic myelogenous	49	26	23	11–69 (42)	13	36
Chronic lymphatic	51	29	22	2–85 (53)	20	35
Acute (4 myelogenous, 6 lymphatic)	10	7	3	1–61 (22)	1 5	10
HODGKIN'S DISEASE	143	91	52	4–51 (35)	15	91
LYMPHOSARCOMA	77	44	33	2–74 (48)	10	43
POLYCYTHEMIA RUBRA	7	6	1	24–71 (49)	6 yr	6

TABLE II IRRADIATION METHODS AND SUPPLEMENTARY THERAPY IN 337 CASES OF DISEASE OF THE HEMOPOIETIC SYSTEM 1929–1945

Disease	No of Cases	Roentgen Local	Roentgen Spray	Radium	Radio Phosphorus	Chemotherapy Fowler's Solution	Chemotherapy Nitrogen Mustards
LEUKEMIA	110	105	15	2	1	22	2
Chronic myelogenous	49	48	8	2		20	1
Chronic lymphatic	51	50	4			2	1
Acute	10	7	3		1		
HODGKIN'S DISEASE	143	142	9	1			5
LYMPHOSARCOMA	77	76	10	1			6
POLYCYTHEMIA RUBRA	7	6	1		2		1

of skin lesions and small superficial nodes do we prefer h v l 0 24 mm Cu (135 kv , 3 0 mm Al equivalent intrinsic filtration only) The use of smaller portals and less crossfiring with hard rays is a disadvantage in the treatment of these diseases The results with radium therapy reported by Craver and others demonstrate that equal effects can be obtained within a wide range of radiation qualities, provided that each part of the diseased tissue receives a sufficient dose and that excessive local and volume doses are avoided

In the great number of modifications which the roentgen technic has to undergo in its adaptation to the special needs of the individual case, we have adhered, in the last eight years, to the following main principles In all cases with generalized disease the minimum doses necessary to produce a remission were given In localized single manifestations of Hodgkin's disease and lymphosarcoma we felt justified in giving high total doses, of the order of 2,000 to 4,000 r in the diseased tissue in a curative attempt The total treatment time was kept as short as compatible with the patient's condition As a rule, daily treatments were given, but treatment was limited to one or two areas per day

Treatment courses were repeated only in the presence of symptoms and signs indicating activity of the disease, not prophylactically Nor did we give routine prophylactic irradiation to adjacent internal lymph nodes in the treatment of superficial adenopathy Though we are fully aware of the utmost importance of treating all foci of disease in the earliest phase of development and see a potential advantage of internal irradiation with radioactive isotopes and of chemotherapy in an effect on subclinical foci, we have found it of advantage to keep the average patient under very close surveillance and to direct external irradiation by clinical observation and laboratory findings

Total body or wide-field spray irradiation was given chiefly to patients in advanced stages of disease, with decreased response to local irradiation Though, as a rule, remissions were thus obtained,

no instance of essential influence on the course of the disease was observed In the few cases of chronic leukemia in which this technic was used initially, it became, without exception, after the first remissions, less effective in the control of markedly enlarged lymph nodes and splenomegaly than local irradiation, which was added or substituted

The radiation quality routinely used in total body or wide-field spray irradiation was h v l 1 5 mm Cu In the initial treatment of leukemia a total dose of 50 r D_0, in five fractions of 10 r, was most frequently given The maximum dose applied in advanced stages of Hodgkin's disease and lymphosarcoma was 200 r D_0 to the anterior surface of the total body, and an equal amount to the posterior surface

It appears noteworthy that in two patients with myelogenous leukemia marked clinical and hematological improvement and regression of the splenomegaly were observed after total body irradiation with h v l 0 25 mm Cu and single and total doses not higher than were routinely given with h v l 1 5 mm Cu Studies of the relative effectiveness of different volume doses as given with different radiation qualities are being continued

Radium therapy of blood diseases has chiefly been practised at institutions in possession of a radium bomb with several grams of radium, in the form of fractionated local irradiation, without essential advantage over roentgen therapy Though radium is especially suited for continuous irradiation, continuous total body exposure to gamma rays, similar to the exposure to roentgen rays in the Heublein unit of the Memorial Hospital, has not been practised systematically A method of external irradiation with radioactive isotopes may develop along this line

Two of the radium treatments listed for our patients were radium bomb treatments given prior to the admission to our clinic Our two applications illustrate the usefulness of radium as an occasional supplement of roentgen therapy In a very obese woman with a reticulum-cell sarcoma confined to the pelvic lymph nodes, intravaginal radium application followed external roentgen irradiation In a second case, a patient in the final stage of Hodgkin's disease, with a huge painful spleen underlying skin with marked radiation damage, an analgesic effect was obtained with a radium mold

The patients who received nitrogen mustard in addition to irradiation form two groups The first is composed of patients in advanced stages of Hodgkin's disease and lymphosarcoma who had received extensive irradiation with decreasing response and were carried on with nitrogen mustards The second group consists of patients with the same diseases, with or without previous roentgen therapy, who were referred for local irradiation after nitrogen mustards had failed to decrease the size of large tumors

In polycythemia rubra, three different methods of roentgen therapy were tried 6 patients received conventional local irradiation over the long and short bones, in 2 patients the treatments were directed to the pylorus of the stomach, as recommended by Andersen, Geill and Samuelsen (1), with the object of depressing the intrinsic factor of Castle, which has been associated with the etiology of polycythemia, 1 patient received total body irradiation with the high surface dose of 210 r in eight fractions In 2 cases final resort was had to the use of radiophosphorus

COMPLICATIONS

More than 50 per cent of all roentgen treatments were given to ambulatory patients The conditions requiring hospitalization and complicating irradiation were more frequently manifestations of the disease than results of treatment They included fever, chills, severe anemia, dyspnea, hemorrhage, serous effusions, pain, and general malaise Radiation sickness seldom reached so extreme a degree as is frequently attained by the toxemic reactions after chemotherapy

Slight to medium depression of the white

blood cell count after irradiation was observed in the majority of cases Severe leukopenia, with a drop of the white count to less than 2,000 per cubic millimeter, was rare A drop to 1,000 one month after the discontinuation of roentgen therapy was observed in a single case of chronic myelogenous leukemia At the time of this observation, we were less familiar with the regularity with which recovery from such low levels occurs than after observations following the use of nitrogen mustard compounds

In two patients with chronic lymphatic leukemia, agranulocytosis developed after irradiation Both patients lived for more than two years after this incident

The hemoglobin and red blood cell count were either not affected or were improved under irradiation in the early stages of disease These observations served as a valuable guide in the direction of therapy as well as in regard to prognosis In the late stages, severe anemia precludes irradiation

A depression of the platelet count after irradiation was observed in patients with a tendency to bleeding prior to therapy, as in acute leukemia and in the final stages of the other disorders

All late changes, as induration of the skin or subcutaneous structures, are much less frequently observed now than ten years ago Final severe anemia and leukemoid reactions occur in non-irradiated patients as well as in irradiated ones To my knowledge, there are no statistical data for comparison

Roentgen therapy is ineffective in acute leukemia It is the consensus to regard it as contraindicated unless some local distress, as that caused by large mediastinal lymphadenopathy or splenomegaly, may be relieved by it

Irradiation fastness is the most frequent limitation of the usefulness of roentgen therapy It is rarely encountered from the onset but develops with the progress of the disease and of the therapy Local irradiation changes, as avascularity and excessive fibrosis, need not be present for its development, though they favor it Radioresistance may show remissions, especially after extensive supportive treatment In two cases of Hodgkin's disease, non-responsive enlarged peripheral nodes disappeared under renewed irradiation after the general condition of the patients had improved following prolonged vacations in Florida The technic and dosage were the same as previously, and the interval between courses was too long to assume a cumulative effect Similar observations were made in patients with generalized lymphosarcoma after series of blood transfusions

FOLLOW-UP OBSERVATIONS

On account of the protean nature of Hodgkin's disease and the great variation of the individual course in leukemia and lymphosarcoma, the effectiveness of a palliative measure is extremely difficult to evaluate Valid conclusions require either the statistical evaluation of a large number of cases or close observation of a smaller number of patients over long periods

The analysis of our material as to the frequency and degree of regression of various types of foci of disease and the duration of the remissions is fraught with special difficulty Some of the patients have been seen only sporadically at long intervals In some, roentgen therapy has been continued at other institutions The spacing of the irradiation courses is, therefore, far from being a measure for the duration of remissions

It was possible to determine the length of survival for 221 patients followed from the beginning of therapy until death or to date In the majority of cases, irradiation was started in our clinic as soon as the diagnosis was made In a few patients diagnosis had been established elsewhere and was confirmed by us If the patient had received previous treatments, we dated the survival from the beginning of these treatments, otherwise, from the start of therapy under our direction

The survival is shown in Tables III to VI for the different diseases

		No of Cases	—Until Death— No of Cases	Survival Aver mo	5 yr %	To Date Survival 5 yr %
1	Chronic Myeloid Leukemia	36	35	33	14	14
2	Chronic Lymphatic Leukemia	35	30	30	13	23
3	Hodgkin s Disease	91	69	32	13	21
4	Lymphosarcoma	43	35	11	3	9

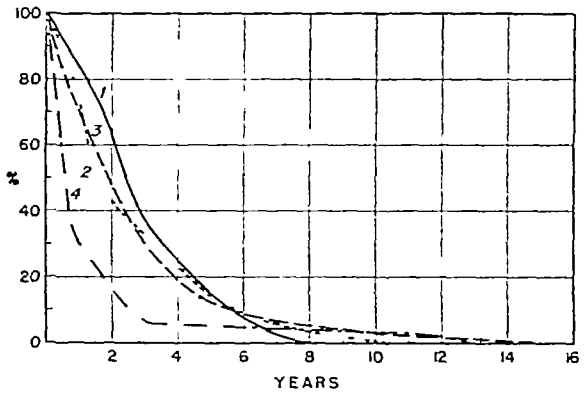

Fig 1 Survival of 205 cases of diseases of the hemopoietic system from beginning of roentgen therapy until death or to date

Two patients were lost to observation after five years Sixty-nine per cent of the patients observed until death died within the first year Only 12 per cent lived over three years

The two asymptomatic patients with a life span of more than five years presented localized adenopathies, one in the pelvis and the other in the mesentery Both received, after exploration, high irradiation doses, of the order of 3,000 to 4,000 r in the lesions In the other patients with a long life span, including the patient who lived thirteen years, multiple foci of disease were present from the beginning Primary foci in the mucous membrane of the upper airways were found in only 3 patients of this series

Of 14 patients in whom an exploratory laparotomy was performed in the presence of a localized tumor causing partial intestinal obstruction, 10 were followed until death With the exception of the 2 patients at present asymptomatic, who have been observed over five years, all patients died within four months

A case of lymphosarcomatosis of the bone marrow is of interest because of the markedly better response to nitrogen mustards than to total body irradiation

Jackson (6) reports a loss of 83 per cent of patients with lymphosarcoma within three years An even more rapid course, with 87 per cent deaths within two years, was observed by Cutler (2) In spite of great radiosensitivity, few if any cases of lymphosarcoma are radiocurable

For 164 cases followed until death the curves of Figure 1 show the difference in the life span after onset of therapy for leukemia, Hodgkin's disease, and lymphosarcoma They do not give correct information on the median duration of each disease, as the material has been collected too recently

Polycythemia Rubra Vera In our experience the results of roentgen therapy have not been very gratifying in polycythemia rubra With any of the three different methods used, symptomatic relief was obtained for two to five months The hematologic effect noticed after treatments directed to the region of the gastric pylorus consisted only in a slight depression of the elevated white blood cell count After irradiation of the long and short bones, a more marked depression of the white cell count was observed The depression of the red blood cell count and of the hemoglobin was slight or negative The splenomegaly remained unaffected

In only one patient, who received the high surface dose of 600 r over each of ten bones, was a remission of eleven months observed A second course with conventional dosage was much less effective This patient died five years after the first roentgen therapy and at least twenty years after the onset of the disease, with a final aplastic anemia and leukemia

In one patient a good symptomatic response and a spectacular hematologic depression, as seen after internal irradiation with P^{32}, was observed after total body exposure to 210 r D_0 in eight fractions The remission, however, lasted only five months

It appears that for the effective treatment of polycythemia rubra relatively high roentgen doses are required, which cannot be repeated frequently without risk

CONCLUSIONS

In conclusion it can be said that roentgen therapy of leukemia, Hodgkin's disease, and lymphosarcoma, judiciously given with the present methods, is an effective palliative measure with a great safety margin and few complications It finds its broadest indication as local irradiation of the various foci of disease

The efficacy of total body irradiation as to a systemic effect and the effect on generalized and subclinical foci is less clean cut It is in these respects that experience with radioactive isotopes and chemical compounds is of special interest and that their therapeutic use might be advantageous

It is our impression that supportive medication with arsenicals is of real value in myelogenous leukemia Our experience with nitrogen mustard compounds as a supportive measure does not yet allow valid conclusions

The dosage required for effective roentgen therapy of polycythemia vera does not allow frequent treatment courses

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SUMARIO

La Irradiación Externa con Rayos X y Radio en el Tratamiento de las Leucemias, Linfomas y Afecciones Afines del Aparato Hematopoyético del Hombre

En el Hospital Billings (Universidad de Chicago) de 1929 a 1945 aceptaron para irradiación un total de 337 enfermos con leucemia, enfermedad de Hodgkin, linfosarcoma y policitemia rubra En los cuatro grupos el tratamiento habitual consistió en irradiación local con rayos X, complementada en algunos casos con irradiación total del cuerpo o en grandes campos, curieterapia y uso de productos químicos (solución de Fowler en la leucemia mielógena, fósforo radioactivo en la policitemia rubra, mostazas del nitrógeno en todos los grupos) Los habituales factores irradiatorios fueron 220 kv , filtración por 1 0 mm de Cu más 1 0 mm de Al, c h -r 1 15 mm de Cu En los enfermos con enfermedad generalizada, se administraron las dosis mínimas necesarias para producir una remisión En las manifestaciones locales de la enfermedad de Hodgkin y el linfosarcoma, pareció justificado administrar dosis totales altas—2,000 a 4,000 r en el tejido patológico—en un esfuerzo curativo La duración total del tratamiento fué lo más breve que permitía el estado del enfermo Por regla general, administráronse tratamientos diarios, limitados a una o dos zonas Sólo se repitieron las series terapéuticas cuando había signos indicativos de actividad de la dolencia

Obtuviéronse las siguientes sobrevivencias de cinco años en la leucemia mielógena crónica (49 casos), 6, en la leucemia linfática crónica (51 casos), 8, enfermedad de Hodgkin (143 casos), 26 (incluso 7 sobrevivencias de 10 años), linfosarcoma (77 casos), 6 Todos los enfermos de leucemia aguda murieron en término de dos meses del tratamiento El resultado en la policitemia roja también fué desalen-

no instance of essential influence on the course of the disease was observed In the few cases of chronic leukemia in which this technic was used initially, it became, without exception, after the first remissions, less effective in the control of markedly enlarged lymph nodes and splenomegaly than local irradiation, which was added or substituted

The radiation quality routinely used in total body or wide-field spray irradiation was h v l 1 5 mm Cu In the initial treatment of leukemia a total dose of 50 r D_0, in five fractions of 10 r, was most frequently given The maximum dose applied in advanced stages of Hodgkin's disease and lymphosarcoma was 200 r D_0 to the anterior surface of the total body, and an equal amount to the posterior surface

It appears noteworthy that in two patients with myelogenous leukemia marked clinical and hematological improvement and regression of the splenomegaly were observed after total body irradiation with h v l 0 25 mm Cu and single and total doses not higher than were routinely given with h v l 1 5 mm Cu Studies of the relative effectiveness of different volume doses as given with different radiation qualities are being continued

Radium therapy of blood diseases has chiefly been practised at institutions in possession of a radium bomb with several grams of radium, in the form of fractionated local irradiation, without essential advantage over roentgen therapy Though radium is especially suited for continuous irradiation, continuous total body exposure to gamma rays, similar to the exposure to roentgen rays in the Heublein unit of the Memorial Hospital, has not been practised systematically A method of external irradiation with radioactive isotopes may develop along this line

Two of the radium treatments listed for our patients were radium bomb treatments given prior to the admission to our clinic Our two applications illustrate the usefulness of radium as an occasional supplement of roentgen therapy In a very obese woman with a reticulum-cell sarcoma confined to the pelvic lymph nodes, intravaginal radium application followed external roentgen irradiation In a second case, a patient in the final stage of Hodgkin's disease, with a huge painful spleen underlying skin with marked radiation damage, an analgesic effect was obtained with a radium mold

The patients who received nitrogen mustard in addition to irradiation form two groups The first is composed of patients in advanced stages of Hodgkin's disease and lymphosarcoma who had received extensive irradiation with decreasing response and were carried on with nitrogen mustards The second group consists of patients with the same diseases, with or without previous roentgen therapy, who were referred for local irradiation after nitrogen mustards had failed to decrease the size of large tumors

In polycythemia rubra, three different methods of roentgen therapy were tried 6 patients received conventional local irradiation over the long and short bones, in 2 patients the treatments were directed to the pylorus of the stomach, as recommended by Andersen, Geill and Samuelsen (1), with the object of depressing the intrinsic factor of Castle, which has been associated with the etiology of polycythemia; 1 patient received total body irradiation with the high surface dose of 210 r in eight fractions In 2 cases final resort was had to the use of radiophosphorus

COMPLICATIONS

More than 50 per cent of all roentgen treatments were given to ambulatory patients The conditions requiring hospitalization and complicating irradiation were more frequently manifestations of the disease than results of treatment They included fever, chills, severe anemia, dyspnea, hemorrhage, serous effusions, pain, and general malaise Radiation sickness seldom reached so extreme a degree as is frequently attained by the toxemic reactions after chemotherapy

Slight to medium depression of the white

blood cell count after irradiation was observed in the majority of cases. Severe leukopenia, with a drop of the white count to less than 2,000 per cubic millimeter, was rare. A drop to 1,000 one month after the discontinuation of roentgen therapy was observed in a single case of chronic myelogenous leukemia. At the time of this observation, we were less familiar with the regularity with which recovery from such low levels occurs than after observations following the use of nitrogen mustard compounds.

In two patients with chronic lymphatic leukemia, agranulocytosis developed after irradiation. Both patients lived for more than two years after this incident.

The hemoglobin and red blood cell count were either not affected or were improved under irradiation in the early stages of disease. These observations served as a valuable guide in the direction of therapy as well as in regard to prognosis. In the late stages, severe anemia precludes irradiation.

A depression of the platelet count after irradiation was observed in patients with a tendency to bleeding prior to therapy, as in acute leukemia and in the final stages of the other disorders.

All late changes, as induration of the skin or subcutaneous structures, are much less frequently observed now than ten years ago. Final severe anemia and leukemoid reactions occur in non-irradiated patients as well as in irradiated ones. To my knowledge, there are no statistical data for comparison.

Roentgen therapy is ineffective in acute leukemia. It is the consensus to regard it as contraindicated unless some local distress, as that caused by large mediastinal lymphadenopathy or splenomegaly, may be relieved by it.

Irradiation fastness is the most frequent limitation of the usefulness of roentgen therapy. It is rarely encountered from the onset but develops with the progress of the disease and of the therapy. Local irradiation changes, as avascularity and excessive fibrosis, need not be present for its development, though they favor it. Radioresistance may show remissions, especially after extensive supportive treatment. In two cases of Hodgkin's disease, non-responsive enlarged peripheral nodes disappeared under renewed irradiation after the general condition of the patients had improved following prolonged vacations in Florida. The technic and dosage were the same as previously, and the interval between courses was too long to assume a cumulative effect. Similar observations were made in patients with generalized lymphosarcoma after series of blood transfusions.

FOLLOW-UP OBSERVATIONS

On account of the protean nature of Hodgkin's disease and the great variation of the individual course in leukemia and lymphosarcoma, the effectiveness of a palliative measure is extremely difficult to evaluate. Valid conclusions require either the statistical evaluation of a large number of cases or close observation of a smaller number of patients over long periods.

The analysis of our material as to the frequency and degree of regression of various types of foci of disease and the duration of the remissions is fraught with special difficulty. Some of the patients have been seen only sporadically at long intervals. In some, roentgen therapy has been continued at other institutions. The spacing of the irradiation courses is, therefore, far from being a measure for the duration of remissions.

It was possible to determine the length of survival for 221 patients followed from the beginning of therapy until death or to date. In the majority of cases, irradiation was started in our clinic as soon as the diagnosis was made. In a few patients diagnosis had been established elsewhere and was confirmed by us. If the patient had received previous treatments, we dated the survival from the beginning of these treatments, otherwise, from the start of therapy under our direction.

The survival is shown in Tables III to VI for the different diseases.

TABLE III CHRONIC MYELOGENOUS LEUKEMIA SURVIVAL AFTER BEGINNING OF THERAPY IN 49 CASES

Years	Living, 1	Dead, 35	Lost to Observation, 13
Under 1		6 (17%)	4
1–2		7 (20%)	4
2–3		9 (26%)	3
3–4		4 (11 5%)	1
4–5	1	4 (11 5%)	
5–10		5 (14%)	1
Over 10			

Living three years or more, 32 7%
Average survival to death (35 cases), 33 months

TABLE IV CHRONIC LYMPHATIC LEUKEMIA. SURVIVAL AFTER BEGINNING OF THERAPY IN 51 CASES

Years	Living, 5	Dead, 30	Lost to Observation 16
Under 1		8 (27%)	11
1–2	1	9 (30%)	2
2–3		3 (10%)	2
3–4		3 (10%)	1
4–5		3 (10%)	
5–10	3	4 (13%)	
Over 10	1		

Living three years or more, 30%
Average survival to death (30 cases), 30 months

Chronic Myelogenous Leukemia (Table III) Six of 49 patients with chronic myelogenous leukemia lived over five years Their average survival was six years and five months, the longest eight years and one month The average survival of 35 patients followed until death was thirty-three months Sixteen patients, approximately one-third of the whole group without deduction of the untraced, lived three years or more

These figures are in agreement with those in the newer literature Craver reported 4 five-year survivals among 69 cases The average for these 4 patients was six years, for the whole group it was twenty-four months We did not observe any patients who lived as long as some of Widmann's (8), namely, thirteen and nineteen years

Four of the six patients who survived over five years had been given Fowler's solution systematically over long periods The patient with the longest survival was from the beginning treated with very high roentgen doses and remained radioresponsive until death

Chronic Lymphatic Leukemia (Table IV) Eight of 51 patients with chronic lymphatic leukemia lived over five years The average survival of 4 of them followed until death was six years and nine months The longest survival of one of the 4 followed to date is ten years and six months The average survival of the 30 followed until death was thirty months Sixteen patients (30 per cent) of the whole group, including the untraced, lived over three years

In Craver's material, the number of patients with chronic lymphatic leukemia who lived over five years was 7 of 77 (9 1 per cent) In his group, as in ours, the average survival of the five-year survivors was slightly higher and the average survival of the whole group slightly lower than in chronic myelogenous leukemia This observation reflects the greater variation of the individual course in the lymphatic form

In old people chronic lymphatic leukemia frequently takes a relatively benign course Seven of our 8 long-term survivors were over fifty years of age at the onset of the disease The only one in the thirties has a leukopenic form of leukemia This form also tends to progress more slowly The average survival of 5 patients with leukopenic lymphatic leukemia followed until death was thirty-eight months as compared to thirty months for all 30 patients followed until death Six of our 8 long-term survivors had an initial white blood cell count of less than 50,000

All patients with chronic lymphatic leukemia received much less irradiation than those with chronic myelogenous leukemia The response to small doses locally or over the total body was often striking, and similar to that in certain cases of lymphosarcoma Remissions of two to four years' duration and even longer were observed after small doses of roentgen rays

Acute Leukemia All patients with acute leukemia died within two months after treatment and within three months after the onset of symptoms

TABLE V HODGKIN'S DISEASE SURVIVAL AFTER BEGINNING THERAPY IN 143 CASES

Years	Living, 22	Dead, 69	Lost to Observation, 52
Under 1	1	20 (29%)	31
1–2	4	16 (23%)	4
2–3	1	11 (16%)	5
3–4	3	9 (13%)	4
4–5	3	4 (6%)	1
5–10	5	7 (10%)	7
Over 10	5	2 (3%)	

Living three years or more, 35%
Average survival to death (69 cases) 32 months

TABLE VI LYMPHOSARCOMA SURVIVAL AFTER BEGINNING OF THERAPY IN 77 CASES

Years	Living, 8	Dead, 35	Lost to Observation, 34
Under 1		24 (69%)	23
1–2	1	5 (14%)	5
2–3	4	4 (11%)	3
3–4		1 (3%)	1
4–5			1
5–10	3		2
Over 10		1 (3%)	

Living three years or more, 12%
Average survival to death (35 cases), 11 months

Hodgkin's Disease (Table V) Seven of 143 patients with Hodgkin's disease are known to have lived over ten years, and 26 over five years Ten of these patients are still living, 9 are known to be dead, with an average survival of nine years and six months, 7 are untraced after observation periods of five years to eight years and four months The average survival for the total number of patients followed until death is thirty-two months

Five patients are living after more than ten years, namely, fifteen years, fourteen years and six months, twelve years, eleven years, and ten years and three months The longest survival until death was fourteen years and eight months Thirty-five per cent of the total group lived three years or more

Our pathologists had not, from the beginning, divided the cases of Hodgkin's disease into the three groups of paragranuloma, granuloma, and sarcoma In re-examining the slides of the 26 patients who were observed longer than five years, we assigned less than 50 per cent to the paragranuloma group In one of the 26 patients our pathologist and Broders concurred in a diagnosis of Hodgkin's sarcoma

In 3 of the long-term survivors, the first manifestation of the disease was a localized lymphadenopathy, in 2 patients of peripheral glands and in the third in the mediastinum In the 2 patients with a peripheral focus the disease remained controlled after a single course with high dosage to this focus In one case the dose was 3,000 r in ten days at 3 cm depth in the axilla, followed by a moist epidermite, in the other, 2,600 r D_0 in 110 days to a cervical lymph node tumor The primary focus in the mediastinum received a depth dose of 2,100 r in twenty-one days No local recurrence became evident, but generalized lymphadenopathy occurred in the second year after the initial therapy

Six patients of the 26 with a long life span showed mediastinal involvement In all of them complete or very marked regression was obtained The minimum depth dose delivered in these cases was 2,000 r in the mediastinum in fifteen to sixty days

Jackson and Parker (7) have called attention to two points which may or may not indicate a greater efficacy of the more recent roentgen therapy methods in Hodgkin's disease The first is the steady rise of the five-year survival figures recorded in the literature, from 10 per cent in the report by Desjardins and Ford (4) in 1923 to 18 per cent reported in 1932 from Holfelder's institute and 34 per cent in Gilbert's (5) series in 1939 The second is the different picture presented by the survival figures of the patients followed until death and those of the living patients followed to date In their own series, the average course of the disease was much longer for those still living In our material the same difference becomes apparent But the analyzed series are too small to be beyond statistical error

Lymphosarcoma (Table VI) Of 77 patients with lymphosarcoma, one died 13 years after the beginning of therapy Three patients are living longer than five years, 2 without evidence of disease

	No of Cases	Until Death: No of Cases	Until Death: Survival Aver mo	Until Death: Survival 5 yr %	To Date Survival 5 yr %
1 Chronic Myeloid Leukemia	36	35	33	14	14
2 Chronic Lymphatic Leukemia	35	30	30	13	23
3 Hodgkin s Disease	91	69	32	13	21
4 Lymphosarcoma	43	35	11	3	9

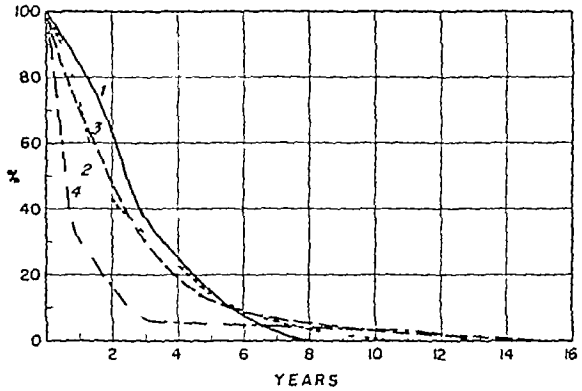

Fig 1 Survival of 205 cases of diseases of the hemopoietic system from beginning of roentgen therapy until death or to date

Two patients were lost to observation after five years Sixty-nine per cent of the patients observed until death died within the first year Only 12 per cent lived over three years

The two asymptomatic patients with a life span of more than five years presented localized adenopathies, one in the pelvis and the other in the mesentery Both received, after exploration, high irradiation doses, of the order of 3,000 to 4,000 r in the lesions In the other patients with a long life span, including the patient who lived thirteen years, multiple foci of disease were present from the beginning Primary foci in the mucous membrane of the upper airways were found in only 3 patients of this series

Of 14 patients in whom an exploratory laparotomy was performed in the presence of a localized tumor causing partial intestinal obstruction, 10 were followed until death With the exception of the 2 patients at present asymptomatic, who have been observed over five years, all patients died within four months

A case of lymphosarcomatosis of the bone marrow is of interest because of the markedly better response to nitrogen mustards than to total body irradiation

Jackson (6) reports a loss of 83 per cent of patients with lymphosarcoma within three years An even more rapid course, with 87 per cent deaths within two years, was observed by Cutler (2) In spite of great radiosensitivity, few if any cases of lymphosarcoma are radiocurable

For 164 cases followed until death the curves of Figure 1 show the difference in the life span after onset of therapy for leukemia, Hodgkin's disease, and lymphosarcoma They do not give correct information on the median duration of each disease, as the material has been collected too recently

Polycythemia Rubra Vera In our experience the results of roentgen therapy have not been very gratifying in polycythemia rubra With any of the three different methods used, symptomatic relief was obtained for two to five months The hematologic effect noticed after treatments directed to the region of the gastric pylorus consisted only in a slight depression of the elevated white blood cell count After irradiation of the long and short bones, a more marked depression of the white cell count was observed The depression of the red blood cell count and of the hemoglobin was slight or negative The splenomegaly remained unaffected

In only one patient, who received the high surface dose of 600 r over each of ten bones, was a remission of eleven months observed A second course with conventional dosage was much less effective This patient died five years after the first roentgen therapy and at least twenty years after the onset of the disease, with a final aplastic anemia and leukemia

In one patient a good symptomatic response and a spectacular hematologic depression, as seen after internal irradiation with P^{32}, was observed after total body exposure to 210 r D_0 in eight fractions The remission, however, lasted only five months

It appears that for the effective treatment of polycythemia rubra relatively high roentgen doses are required, which cannot be repeated frequently without risk

CONCLUSIONS

In conclusion it can be said that roentgen therapy of leukemia, Hodgkin's disease, and lymphosarcoma, judiciously given with the present methods, is an effective palliative measure with a great safety margin and few complications It finds its broadest indication as local irradiation of the various foci of disease

The efficacy of total body irradiation as to a systemic effect and the effect on generalized and subclinical foci is less clean cut It is in these respects that experience with radioactive isotopes and chemical compounds is of special interest and that their therapeutic use might be advantageous

It is our impression that supportive medication with arsenicals is of real value in myelogenous leukemia Our experience with nitrogen mustard compounds as a supportive measure does not yet allow valid conclusions

The dosage required for effective roentgen therapy of polycythemia vera does not allow frequent treatment courses

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En el Hospital Billings (Universidad de Chicago) de 1929 a 1945 aceptaron para irradiación un total de 337 enfermos con leucemia, enfermedad de Hodgkin, linfosarcoma y policitemia rubra En los cuatro grupos el tratamiento habitual consistió en irradiación local con rayos X, complementada en algunos casos con irradiación total del cuerpo o en grandes campos, curieterapia y uso de productos químicos (solución de Fowler en la leucemia mielógena, fósforo radioactivo en la policitemia rubra, mostazas del nitrógeno en todos los grupos) Los habituales factores irradiatorios fueron 220 kv , filtración por 1 0 mm de Cu más 1 0 mm de Al, c h -r 1 15 mm de Cu En los enfermos con enfermedad generalizada, se administraron las dosis mínimas necesarias para producir una remisión En las manifestaciones locales de la enfermedad de Hodgkin y el linfosarcoma, pareció justificado administrar dosis totales altas—2,000 a 4,000 r en el tejido patológico—en un esfuerzo curativo La duración total del tratamiento fué lo más breve que permitía el estado del enfermo Por regla general, administráronse tratamientos diarios, limitados a una o dos zonas Sólo se repitieron las series terapéuticas cuando había signos indicativos de actividad de la dolencia

Obtuviéronse las siguientes sobrevivencias de cinco años en la leucemia mielógena crónica (49 casos), 6, en la leucemia linfática crónica (51 casos), 8, enfermedad de Hodgkin (143 casos), 26 (incluso 7 sobrevivencias de 10 años), linfosarcoma (77 casos), 6 Todos los enfermos de leucemia aguda murieron en término de dos meses del tratamiento El resultado en la policitemia roja también fué desalen-

tador, siendo las dosis requeridas demasiado altas para repetirlas

De lo anterior se deduce que, en la leucemia, la enfermedad de Hodgkin y el linfosarcoma, la roentgenoterapia, juiciosamente administrada con las técnicas actuales, constituye una eficaz medida paliativa con un gran margen de seguridad y pocas complicaciones La eficacia de la irradiación total del cuerpo no parece tan clara En la leucemia mielógena, la medicación tónica con arsenicales parece ser de valor Las observaciones con las mostazas del nitrógeno como medida tónica fueron demasiado limitadas para poder sacar conclusiones válidas

Chemotherapy in Human Lymphomas, Leukemias, and Allied Disorders of the Hemopoietic System[1]

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THE ATTEMPT TO control leukemia by toxic chemicals dates to 1865, when Lissauer obtained marked symptomatic relief following administration of Fowler's solution (potassium arsenite) Cutler and Bradford, in 1878, were the first to quantitate the changes in leukemia by blood studies After the reports of Pusey in 1902 and Senn in 1903 on the value of roentgen therapy in the disease, the effect of arsenic was largely forgotten Naegeli, in 1930, recommended arsenical compounds in the control of leukemia, and the studies of Forkner and Scott (1931, 1932) reestablished Fowler's solution as an efficacious adjunct in the treatment of chronic myeloid leukemia They showed a considerable reduction in the leukocytes with a decrease or disappearance of the immature forms, the anemia was arrested, and frequently there was a marked reticulocytosis Platelet levels were seldom affected even in the leukopenic phase of treatment Improvement in the splenomegaly, hepatomegaly, and lymphadenopathy were usually seen Stephens and Lawrence (1936) fully confirmed these observations Fowler's solution was found to be most effective in early cases of myeloid leukemia, but Forkner and Scott (1931) demonstrated its value in some cases which had become resistant to roentgen therapy Today we recognize the limited value of arsenic in controlling early myeloid leukemia and as an adjunct to roentgen therapy

Benzol represents another notable chemotherapeutic attack upon the leukemias and lymphomas Korányi (1912), supported by Selling's study (1910–16) of three cases of chronic benzene poisoning, was the first to treat leukemia with benzol Like arsenic, this compound was most effective against myeloid leukemia Fear of its irregular and cumulative reaction in the marrow, precipitating an aplastic anemia, has caused Americans to discontinue its use, although it is still favored in a few European clinics Kalapos (1935) and Forkner (1938) have carefully reviewed the literature and concluded that the injudicious use of benzol together with reports of animal experiments with excessive doses were chiefly responsible for bringing it into disrepute

In England, Haddow and Sexton (1946) have made a comprehensive study of the effect of several carbamate esters (urethanes) on the growth of animal tumors These substances, selected because they had been shown to inhibit growth in plants, dramatically retarded the growth of Walker rat carcinoma 256 Clinical trials using urethane and isopropyl phenylcarbonate were then undertaken Slight amelioration of carcinomas and lymphomas were noted but the results were mainly negative The observation by Dr Edith Paterson (1946) that urethane produced a fall in leukocyte count suggested its use in leukemia, and a group of 32 cases was treated Among 19 cases of myeloid leukemia, 10 were improved for six months or longer and 5 for two months to six months, while 4 cases showed no response Five of 13 patients with lymphatic leukemia showed a response for six months or more, but 2 of these also received x-ray therapy In the remaining 8 the response was poor In those bene-

[1] From the Department of Medicine The University of Chicago This work was done under a grant from the American Cancer Society on the recommendation of the Committee on Growth, of the National Research Council Presented at the Thirty second Annual Meeting of the Radiological Society of North America, Chicago, Ill , Dec 1-6, 1946

TABLE I SERIAL COUNTS, BY WEEKS, ON STERNAL MARROW FOLLOWING INTRAVENOUS ADMINISTRATION OF METHYL BIS(β CHLOROETHYL)AMINE HYDROCHLORIDE*

Cell Types	0	1	2	3	4	5	6
Blasts and promyelocytes	2 3	1 6	4 6	2 0	2 8	1 3	
Myelocytes	15 0	9 0	10 5	17 6	10 1	7 1	12 3
Metamyelocytes	34 7	26 3	16 3	20 3	37 6	13 7	16 3
Polymorphonuclears	42 0	55 2	58 0	48 0	41 7	67 1	43 4
Lymphocytes	3 7	6 1	6 0	10 2	14 6	17 0	17 0
Pro and baso erythroblasts	6 0	1 5	2 0	8 5	7 1	3 8	3 0
Poly- and orthochromic erythroblasts	26 0	5 0	4 3	18 3	31 3	40 3	46 0
Nucleated cells × 10^3	100 0	87 0	29 0	17 2	65 4	53 6	45 8

* Composite table shows the total nucleated cells and differential counts on sternal marrow aspiration following intravenous injection of methyl bis(β-chloroethyl)amine hydrochloride, 4 doses, average total dose 22 mg

fited, there was a resolution of the splenomegaly and lymphadenopathy, the hemoglobin increased, and the leukocyte and differential counts reverted to near normal levels The results suggest that, while this type of therapy may be of value in chronic myeloid leukemia, it is of little or no benefit in acute and lymphatic leukemia

Our interest in the chemotherapeutic effects of the nitrogen mustard compounds upon neoplasms developed from their characteristic cytotoxic properties The degree of toxicity of this group of substances parallels the proliferative activity of the cells and is especially striking in the hemopoietic system Hence, a trial in controlling various blood dyscrasias seemed promising

Two nitrogen mustard compounds have thus far been studied Late in 1942, Gilman *et al* injected tris(β-chloroethyl) amine hydrochloride intravenously in a group of terminal cases of a number of neoplastic diseases Independently, early in 1943, we began studies on the lymphomas, using methyl bis(β-chloroethyl) amine hydrochloride, and noted a remission of Hodgkin's disease, lymphosarcoma, and chronic lymphatic leukemia (Gilman and Philips, 1946, Jacobson, Spurr, *et al*, 1946, Goodman, Wintrobe, *et al*, 1946, Karnofsky, Craver, *et al*, 1947, Spurr, Jacobson, *et al*, 1947) Daily doses of 0 1 mg per kilogram of body weight have been given in courses of four injections on consecutive days The toxic reactions consist of nausea and vomiting, which may appear two to three hours following the injection and persist for a similar period The reaction of the hemopoietic system becomes manifest over a period of three weeks In the peripheral blood, a lymphopenia develops within one to five days, a leukopenia may be present in the third week but is usually of only one week duration A variable degree of thrombocytopenia may develop and, with it, an increase in the bleeding time, but purpuric manifestations have been rare The changes in the peripheral blood are a reflection of injury to the marrow Serial sternal aspirations and rib biopsies indicate that extreme marrow destruction may occur Table I is a composite tabulation based upon semiweekly marrow aspirations following a course of 25 mg of this nitrogen mustard compound The total nucleated cell count falls from a normal level of 100,000 per cubic millimeter to 17,000 in the third week following treatment At this stage, there is already evidence of regeneration in the myeloid and erythroid series This progresses in an orderly manner, and in the sixth week, there is an active regenerative marrow In the sixth to eighth week following

TABLE II HODGKIN'S DISEASE AVERAGE PERIOD OF REMISSION AND INCIDENCE OF LEUKOPENIA FOLLOWING VARIOUS COURSES OF METHYL BIS-(β-CHLORO-ETHYL)AMINE HYDROCHLORIDE

No Injections (days)	1	2	3	4	5	6
No cases	2	6	6	42	5	18
Average dose (mg)	5 2	11 9	18 9	25 30 1	36 7	
Percentage of leukopenia less than 2,000	0	16	66	54	40	54
Average remission in months	0 75	1 6	2 0	2 2 1	6	3 3

TABLE III CUMULATIVE EFFECT OF REPEATED DOSES OF METHYL BIS(β CHLOROETHYL)AMINE HYDROCHLORIDE*

Cumulated dose (mg)	0–50	50–100	100–150	150–200	200–300
Number of courses of drug	15	15	12	9	7
Average cumulated dose	29 1	76 5	120 8	175 9	251 7
Average dose of last course	24 2	25 3	23 4	26 0	26 7
Average leukocyte count, pre treatment	8,880	7,710	6,355	6 930	6 320
Average minimum leukocyte count, post-treatment	4,410	2,930	2,860	2,660	2,230
Average per cent fall of leukocytes	61 3	66 2	66 0	62 2	64 8
Average per cent fall of neutrophils	61 5	58 3	63 5	68 8	72 1
Average per cent fall of lymphocytes	55 4	48 8	56 2	56 5	54 8
Per cent incidence of leukopenia <3000	40	46 6	58 2	66 8	86 9

* This table shows the reaction of the peripheral blood to four injections, total dose 24 to 28 mg Courses are grouped according to the sum total cumulated dose in order to evaluate the effect of repeated doses

therapy, the marrow cellularity returns to normal limits

In utilizing therapeutically the cytotoxic properties of a compound, a dose must be selected which does not seriously injure vital tissue The affinity of the nitrogen mustard compounds for the hemopoietic cells suggests that the margin of safety may best be evaluated by following the leukopenic reaction after a course of treatment Table II illustrates the incidence of leukopenia and the average remission (in months) following courses of one to six consecutive daily injections In 54 per cent of the cases receiving a course of four injections, average total dose 25 mg, a leukopenia of 2,000 cells per cubic millimeter, or less, developed Not until this dose was reached did a leukopenia of 1,000 appear, and with higher doses the duration and severity of leukopenia increased The average remission following such a course is 2 2 months, or one month longer than is required for complete regeneration of the bone marrow Thus, a course of four consecutive daily doses totaling 25 to 30 mg was selected tentatively as most efficacious

Experience with chemotherapeutic agents has taught us that consideration must be given to the possible cumulative effects upon the bone marrow Thus far, we have cumulated doses up to 300 mg To evaluate the reaction of the hemopoietic system, we have grouped the cases in 50-mg steps and compared the average reaction of leukocytes at pre-treatment and post-treatment levels, as well as the incidence of leukopenia (Table III) We have noticed a slight, and as yet insignificant, lowering of the leukocytes and an increase in the incidence of leukopenia in the patients receiving a cumulative dose of 300 mg This study must be extended to levels of 600 mg, since this cumulated dose will be reached in treating a case over the average duration of Hodgkin's disease We have not found any cumulative suppression of the erythrocytes which could be assigned to the drug At present, there is only equivocal evidence that an inherent hypoplasia of the marrow may develop

The clinical studies with nitrogen mustards are still too brief to discuss definitive results Over a four-year period, we have used methyl bis(β-chloroethyl) amine hydrochloride in a variety of malignant conditions of the hemopoietic system The remissions produced in Hodgkin's disease (one to ten months), lymphosarcoma (one to ten months), chronic lymphatic leukemia (two to twenty-four months), and myelogenous leukemia (zero to three months) are no longer, and occasionally shorter, than those produced by roentgen therapy There is no indication that remissions were produced in reticulum-cell sarcoma, acute leukemia, multiple myeloma, and sympathicoblastomas Variable but probably significant remissions have been observed in polycythemia rubra

Three cases are summarized to illustrate the response following treatment

TABLE IV CASE I BIOPSY DIAGNOSIS HODGKIN'S DISEASE MALE AGED 51 ONSET IN 1940

X-Ray Therapy
(200 kv , 20 ma , Thoraeus filter, 19 r/min in air)

	Size of Ports (cm)	No Treatments	Dose per Treatment	Course and Total Result
Series I 4/7–4/22/41				
Left neck	10 × 10	10	200 r	4,000 r in 14 days Remission fo
Posterior mediastinum	10 × 10	10	200 r	approximately 9 months
Series II 9/12–9/24/42				
Anterior mediastinum	10 × 10	5	250 r (3), 250 r (2)	1,150 r } Remission fo
Posterior mediastinum	12 × 15	5	200 r (1), 250 r (4)	1,200 r in 12 days } approximatel 6 months
Series III 1/3–1/15/44				
Left axilla	10 × 10	11	200 r	2,200 r Partial remission on month Local recurrence an fever

Methyl bis (β-Chloroethyl)amine Hydrochloride

	Total Dose (mg)	Hemoglobin, max -min (gm)	Erythrocytes, max -min ($\times 10^6$)	Leukocytes, max -min	Leukopenia <3,000 (days duration)	Remission (months)	Remarks
I 5/17–5/20/44	26 8	10 8 11 6	3 17 3 34	10,100 1,700	4	3	Resolution of lymphadenopathy (peripheral and mediastinal)
II 8/24–8/27/44	29 4	12 9 11 3	4 31 3 50	5,400 1,200	10	3	Anemia improved hilar enlargemen only sign of ac tivity
III 12/20–12/24/44	30 8	14 0 14 4	4 2 4 3	6,000 2,000	7	3	As above
IV 4/13–4/17/45	25 6	12 8 11 5	3 8	9,100 5,400	2	2 5	Axillary, cervical and hilar nodes resolved
V 7/19–7/21/45	20 4	10 5 12 5	3 64 3 8	3,525 1,100	21	3	Resolution of all lymphadenopathy following HN 2
VI 11/22–11/26/45	27 8	11 3	3 1	12,000	0	2 5+	Response as above
VII 3/3–3/6/46	27 8	12 0 10 6	3 6 3 4	11,250 3,100	15	2 0	Response as above, hilar mass enlarging at two months
VIII 5/7–5/11/46	28 0	11 7 10 8	3 6 3 2	7,100 1,200	7	3 0(?)	Symptoms improved, hilar mass partially resolved, quiescent two months
IX. 8/5–8/9/46	26 4	11 5 10 5	3 7 3 4	7,500 2 000	5	Partial	Symptoms improved, hilar mass enlarging
X 12/17–12/20/46	24 0	10 5 13 5	4 2 5 2	7,500		None	Transfusion 12/21 Respiratory obstruction improved Death 1/7/47

X-Ray Therapy
(180 kv , 20 ma , 1 0 mm Al filter, 50 cm F S D , 35 r/min in air)

	Size of Ports (cm)	No Treatments	Dose per Treatment	Course and Total Result
Series IV 9/20–10/10/46				
Left anterior chest	15 × 11 } 15 × 15 }	8	200 r (2) 300 r (3), 250 r (3)	} 2,800 r in 20 days No change in mediastinal mass
Left posterior chest	15 × 15	3	250 r	
Series V 11/1–11/16/46				
Anterior abdomen	12 × 17	4	200 r (1), 300 r (3)	Some symptomatic improvement
Right posterior abdomen	10 × 15	4	200 r (1) 300 r (3)	Progressive evidence of mediastinal obstruction Return of
Left posterior abdomen	10 × 15	4	300 r	abdominal pain in three weeks 3,400 r in 16 days

TABLE V CASE II BIOPSY DIAGNOSIS LYMPHOSARCOMA FEMALE AGED 24 YEARS INITIAL SYMPTOMS IN 1943 NO PREVIOUS THERAPY

Date	Methyl bis(β-chlorethyl)amine HCl Daily doses	Hemoglobin, max -min (gm)	Erythrocytes, max -min (× 10⁶)	Leukocytes, max -min	Remission (months)	Duration of Leukopenia, <3000 (days)	
4/15/44	20 0 mg	13 9–11 6	4 0–3 6	7,900–2,500	2	7	History Abdominal cramps, nausea, vomiting weight loss, for two years Examination Generalized lymphadenopathy, abdominal mass 8 cm in diameter X-ray Abdominal mass extrinsic to bowel
6/23/44	10 0 mg	12 5–12 2	3 6–3 5	4,900–3,000	2 5	0	Resolution of peripheral lymphadenopathy and abdominal mass
9/30/44	10 0 mg	12 0	3 77	4,700	1 0	0	Therapy given before nodes or symptoms recurred
10/30/44	5 0 mg	13 1	4 10–4 00	5,900–4,000	2 5	0	Only indication of activity was palpable mass Resolved after therapy
11/11/44	5 0 mg	13 1					
1/26/45	15 0 mg	12 6	4 20	3,450	3 0+	0	Same
3/30/45	15 0 mg	13 4	4 10	3,960	4 0	0	Same
9/1/45	15 0 mg	12 6	4 00	6,300	3 0	0	Same
12/26/45	15 0 mg	13 0	3 52	5 000	3 0+	0	Same
4/17/46	15 0 mg	13 5	3 91	6,400	3 0+	0	Same
8/15/46	15 0 mg	15 4	4 52	4,100	3 0+	0	Continues in good health, occasional abdominal distress one to two weeks prior to treatment No lymphadenopathy No palpable mass (February 1948)

CASE I (*Hodgkin's Disease*) F G , a 51-year-old clergyman, was first seen in the Hematology Clinic on April 27, 1944 He gave a history of left cervical lymphadenopathy developing in May 1940 A biopsy was diagnostic of Hodgkin's disease Roentgenographs of the chest showed a prominence of the hilar nodes In April 1941, roentgen therapy was given to the left cervical and posterior mediastinal area, totaling 4,000 r (in air) in fourteen days This produced a remission for nine months In September 1942, because of fever, weakness, anemia, and lymphadenopathy, a second course of roentgen therapy was given to the mediastinum, totaling 2,350 r in twelve days A remission of six months followed The third series of roentgen therapy was given in January 1944, because of marked symptoms, to a large group of tender nodes in the left axilla A remission of only one month followed this course of therapy, and the roentgenologist felt that the patient was becoming resistant to therapy

In May 1944, the first course of nitrogen mustard was given, following which there were resolution of lymphadenopathy and improvement in general health This was maintained by repeating courses of nitrogen mustard every three to four months In May 1946, the mediastinal mass began to enlarge two months following therapy, and two additional courses caused only partial resolution Roentgen therapy was instituted again in September 1946 and a course of 2,800 r directed to the mediastinum in a twenty-day period produced no change in the mass In November 1946, a fifth course of x-ray therapy was directed to the posterior abdomen This produced improvement only in the abdominal symptoms A tenth course of nitrogen mustard was given in December but, despite symptomatic improvement, the patient died on Jan 7, 1947 A detailed summary of his course is presented in Table IV

CASE II (*Lymphosarcoma*) A 22-year-old technician consulted her physician on March 30, 1944, because of recurring intense, cramping, abdominal pain This had been present intermittently for two years but only in the past two months had the patient noticed malaise, low back pain, and more frequent attacks of left upper quadrant pain Physical examination revealed cervical, axillary, right epitrochlear, and inguinal nodes 0 5 to 1 5 cm in diameter There was a mass 8 cm in diameter in the left upper quadrant, but the spleen and liver were not palpable Blood studies showed 13 3 gm hemoglobin, 4,200,000 erythrocytes, 9,100 leukocytes Chest films showed no abnormality Contrast fluoroscopy of the abdomen indicated that the mass was extrinsic to the bowel A biopsy of a lymph node was diagnostic of lymphosarcoma

On April 15, 1944, a series of four consecutive daily injections of 5 0 mg of nitrogen mustard was begun Within one week, there was marked resolution of the lymphadenopathy and abdominal mass There were no longer complaints of cramps or back pains This remission continued for two months, when the abdominal mass was again present, measuring 3 cm in diameter The patient has had seven courses of therapy and, as seen in Table V, lymphadenopathy, body weight, and peripheral blood are well controlled After thirty-six months, she has no

esternón indican que puede sobrevenir destrucción extrema de la médula ósea, seguida de regeneración a las pocas semanas

Tratando de establecer un margen de seguridad al emplear clorhidrato de metilo-bis(β-cloroetilo)amina, observóse la reacción leucopénica tras series de una a seis inyecciones diarias, y sobre esa base se escogió tentativamente como más eficaz una serie de cuatro dosis diarias consecutivas que sumaban 25 a 30 mg También se estudiaron los efectos de dosis acumulativas hasta de 300 mg En los enfermos que recibieron esa dosis máxima observáronse baja insignificante de la fórmula leucocitaria y mayor incidencia de leucopenia No se notó supresión acumulativa de los eritrocitos, y sólo datos equívocos de que puede presentarse hipoplasia inherente de la médula ósea

Clínicamente, se determinó que el compuesto utilizado puede producir remisiones en la enfermedad de Hodgkin, el linfosarcoma y la leucemia linfática crónica, pero el resultado no es superior al obtenido con la roentgenoterapia, aunque se logran remisiones en casos que ya no responden a la última Partiendo de esa base, puede ser digno de investigación un plan terapéutico que utilice la mostaza de nitrógeno como coadyuvante general de la roentgenoterapia local En la policitemia se ha producido remisión clínica, pero los datos preliminares no sugieren que sea superior a la con fósforo radioactivo

A Simple Pelvimeter to Be Used with the Triangulation Method of Pelvimetry[1]

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THE PURPOSE of this paper is to present a simple pelvimeter for use with the triangulation method of pelvimetry This pelvimeter has proved useful in two respects First, it has resulted in considerable time saving in the correction of pelvic measurements Second, it has led to increased accuracy by elimination of steps involved in the usual methods of correction

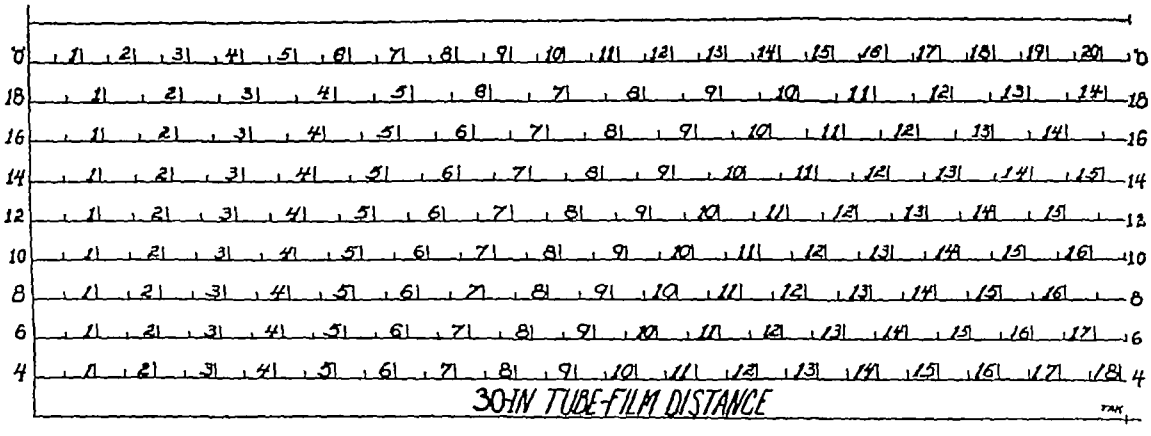

Chart I Chart for 30-inch tube film distance Line 0 is a true centimeter scale, the remaining lines are false centimeter scales (Reduced to approximately two-thirds actual size)

CONSTRUCTION OF THE PELVIMETER

The construction of the pelvimeter is based on the well known and simple principle of similar triangles, in which the true object measurement is to the film measurement as the tube-object distance is to the tube-film distance This is expressed by the formula

$$X = F\,\frac{(H - D)}{H}$$

in which X is the object measurement, F the film measurement, H the tube-film distance, and D the object-film distance With the use of this formula, a set of values was obtained to construct a chart having nine parallel lines (Chart I) The first line is a true centimeter scale The remainder are false centimeter scales used in correction of image measurements of objects at various heights above the table top For example, line 18 is used for correction of film images of objects 18 cm above the table top Line 4 is used for correction of film images of objects 4 cm above the table top Charts were prepared for both 30-inch and 40-inch tube-film distance Copies of these charts were made by a local printer To the back of the charts is pasted a table showing the relationships between diameters, circumferences, and volumes

A local plastic firm sealed the chart between two thin sheets of plastic, using a laminating press (Fig 1) To the left side of the plastic-enclosed chart is fixed a pointer, the medial edge of which is continuous with the left-hand vertical line on the chart A slide was constructed At

[1] Read before the Radiological Section of the Los Angeles County Medical Association, February 12, 1947 Accepted for publication in March 1947

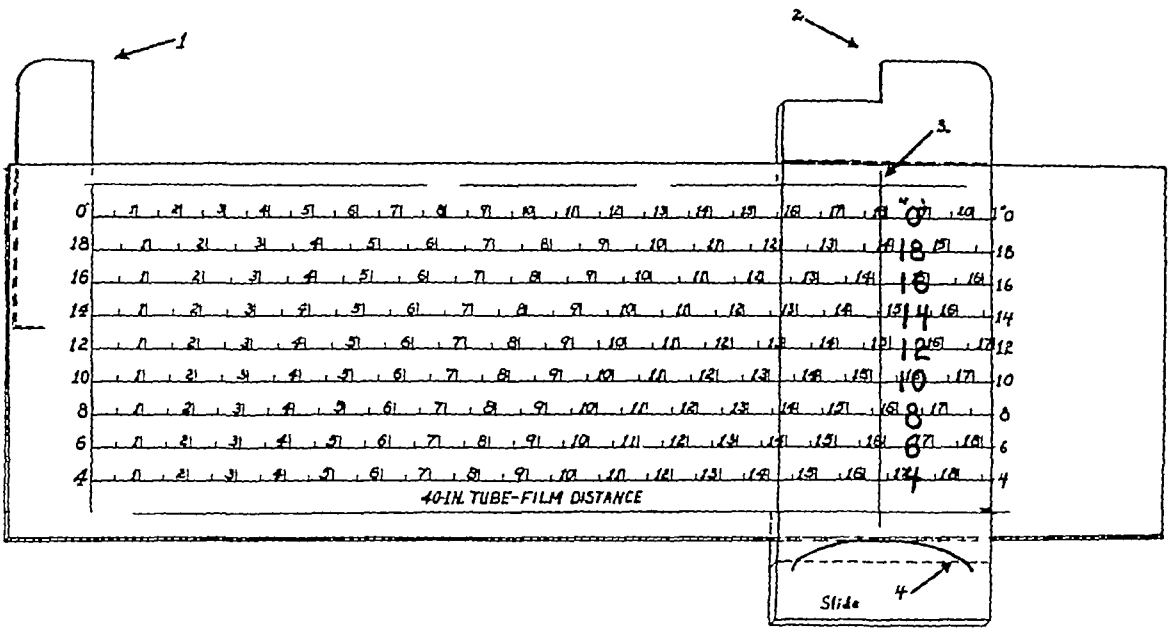

Fig 1 The pelvimeter 1 Pointer fixed to left of plastic enclosed chart 2 Pointer on slide 3 Vertical hair line on slide 4 Segment of watch spring to maintain pressure of slide on chart (Reduced to nearly half actual size)

the upper end is a pointer Continuous with the medial edge of this pointer is a vertical hair line on the face of the slide At the lower end of the slide is a segment of watch spring to maintain the pressure of the slide on the chart On the face of the slide are numbers corresponding to those heading the horizontal lines, to facilitate identification of the particular horizontal line By moving the slide, any distance can be encompassed between the medial edges of the pointers

USE OF THE PELVIMETER

Different writers on pelvimetry select different points for the exact location of the various pelvic diameters The method of using the pelvimeter is the same regardless of the location of these diameters In the illustrations to be given, the location is essentially as described by Snow and Lewis (1, 2), the pelvimeter being used to facilitate correction of the measurements

A lateral and anteroposterior pelvic roentgenogram are all that are required (In practice we obtain an anteroposterior stereoroentgenogram to study the birth canal stereoscopically) Correction factors are necessary for the various diameters as seen in both the anteroposterior and lateral film In the anteroposterior film, since the diameters lie at different heights above the table top, a different correction factor is needed for each In the lateral film, however, all of the desired diameters lie in the mid-sagittal plane, and only a single correction factor is needed One half of the external bitrochanteric diameter gives the height of the mid-sagittal plane above the table top and is, then, the correction factor for all diameters measured on the lateral film The external bitrochanteric diameter is easily measured by the technician at the time that the films are made (the technic rule being useful for this)

Only sufficient examples to illustrate the use of the pelvimeter with this method of pelvimetry will be given [2]

The True Conjugate (Anteroposterior Diameter of the Inlet) To obtain the true conjugate, on the *lateral film* the pelvimeter pointers are placed at points A and B (Fig 2) The value of this diameter is then read

[2] For a complete discussion of this method of pelvimetry, the reader is referred to Snow and Lewis (1) and Snow (2)

where the vertical hair line on the slide (Fig 1) crosses the horizontal line corresponding to the correction factor for the lateral film, that is, one-half the external bitrochanteric diameter

For example Suppose that the slide (Fig 1) is in the position where the pointers are at the ends of the true conjugate Assume that the external bitrochanteric diameter is 32 cm , the "correction factor" for all measurements on the lateral film would be one-half of this, or 16 The true conjugate is read on line 16 where the hair line crosses it In this example the value would be 14 2 cm

Or assume that the external bitrochanteric diameter is 34 cm , then the "correction factor" for all measurements in the lateral film would be 17 Since the correction factor numbers at the ends of the horizontal lines are all even numbers, it is necessary to interpolate between these when the correction factor is an odd number In this example we would obtain the desired true conjugate by interpolating between the lines 16 and 18 (Fig 1), reading the value as 14 0 cm This interpolation is always readily accomplished, as the difference between any two consecutive lines does not exceed 1 0 cm

Posterior Sagittal Diameter of the Outlet To obtain the posterior sagittal diameter of the outlet, it is first necessary to locate the ends of this diameter on the *lateral film* The posterior point is, of course, the tip of the sacrum at the sacrococcygeal joint, point C (Fig 2) The anterior point is obtained as follows A line is extended posteriorly along the inferior margin of each obturator foramen until it intersects the posterior aspect of the ischium The mid-point between the posterior aspect of the two ischii is marked, point D (Fig 2) The pelvimeter pointers are placed at the points C and D, and the posterior sagittal diameter is read where the vertical hair line crosses the horizontal line corresponding to the correction factor for the lateral film (that is, one-half the external bitrochanteric diameter)

Any other desired pelvic diameters located in the mid-sagittal plane are obtained in an identical manner

As mentioned earlier, to obtain the transverse diameters as seen in the anteroposterior film (Fig 3), it is necessary to obtain a different correction factor for each

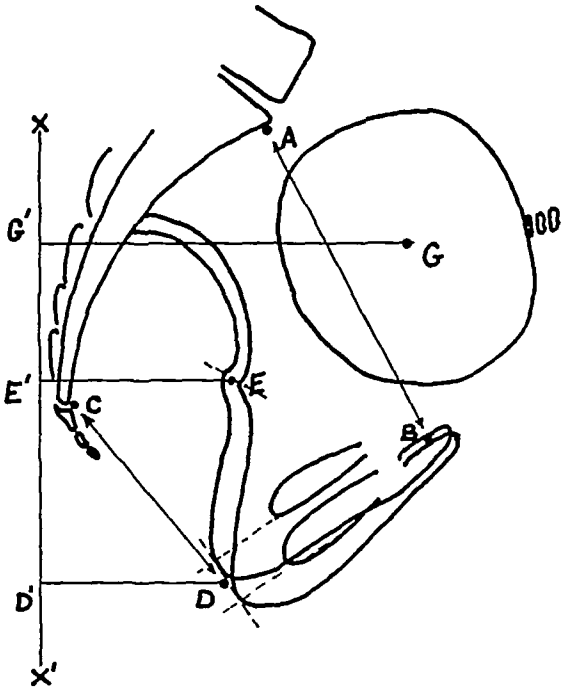

Fig 2 Lateral view X-X' Vertical base line 0 5 cm posterior to the sacrum and parallel to the film edge A Promontory of the sacrum B Mid-point of posterior aspect of the symphysis C Tip of sacrum D Mid-point on bi-ischial diameter E Mid-point on intraspinous diameter G Mid-point on fetal skull

diameter, as each lies at a different height above the table top The correction factors for these diameters are obtained from the *lateral film* (Fig 2) in the following manner

Approximately 1 0 cm posterior to the sacrum a vertical line is drawn parallel to the film edge This corresponds to the location of the table top when the patient is lying supine for the anteroposterior film Lines drawn perpendicular to this to the mid-points of the various transverse diameters as seen in the lateral film represent the height of these transverse diameters above the table top However, since each of these heights lies in the mid-sagittal plane, they must be corrected for distortion The correction factor is, of course, that for all measurements on the lateral film, namely, one-half the external bitrochanteric diameter

Bi-ischial Diameter (Transverse Diameter of the Outlet) Since the point D (Fig 2) represents the mid-point on the bi-ischial

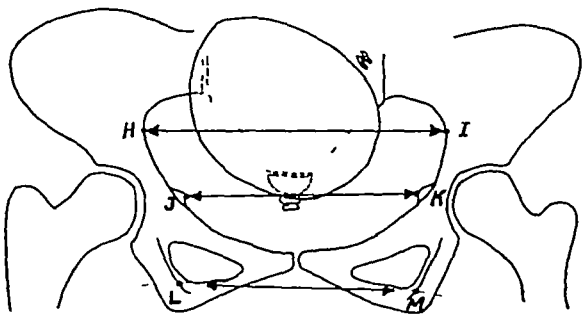

Fig 3 Anteroposterior film L-M Bi-ischial diameter J-K Intraspinous diameter H-I Maximum transverse diameter of the inlet

diameter as seen in the lateral view, D-D′ represents the height of this diameter above the table top The pelvimeter pointers are placed at the points D and D′ (Fig 2) and the "new correction factor" read on the line corresponding to one-half the external bitrochanteric diameter This "new correction factor" is read to the *nearest whole number* On the *anteroposterior film*, the pelvimeter pointers are placed at the ends of the bi-ischial diameter, points L and M (Fig 3) The bi-ischial diameter is read on the line headed by the number of the "new correction factor" just obtained from the lateral film

For example Assume that the external bitrochanteric diameter is 36 cm , then the correction factor for the lateral film would be half of this, 18 Assume that, with the pelvimeter pointers placed at the points D and D′ (Fig 2), the hair line crosses the line 18 at 5 8 or, to use the nearest whole number, 6 Then the "new correction factor" would be 6 The pelvimeter pointers would then be placed at the points L and M (Fig 3) and the bi-ischial diameter read on the line 6 where it is crossed by the hair line

Intraspinous Diameter (Transverse Diameter of the Mid-Pelvis) The intraspinous diameter is obtained in the same manner as the bi-ischial On the *lateral film*, the midpoint between the posterior aspect of the ischial spines is marked, point E (Fig 2) The pelvimeter pointers are placed at the points E and E′ The "new correction factor" is read on the line corresponding to one-half the external bitrochanteric diameter This, also, is read to the *nearest whole number* On the *anteroposterior film* the pelvimeter pointers are placed at the medial edges of the ischial spines, points J and K (Fig 3) The intraspinous diameter is read on the line corresponding to the "new correction factor" just obtained from the lateral film Other transverse diameters are obtained in a like manner

AVERAGE FETAL HEAD CIRCUMFERENCE AND VOLUME

With the fetal head engaging or engaged, the perimeter as seen in the *lateral film* is essentially in the mid-sagittal plane, hence, the correction factor is the same as for other measurements in the lateral film, that is, one-half the external bitrochanteric diameter To obtain a correction factor for the fetal head perimeter as seen in the anteroposterior film, the procedure is identical to that for obtaining the "new correction factor" for the transverse pelvic diameters as described above In this case the mid-point of the fetal skull as seen in the *lateral film* would be marked, point G (Fig 2) Then the line G-G′ would represent the height of the perimeter above the table top when the patient is supine for the anteroposterior film

As described by Snow and Lewis (1, 2), a piece of 1 cm -wide adhesive 50 cm long is rolled with the adhesive side out to form a sticky string This is placed around the perimeter of the fetal skull as seen in the *lateral film* (Fig 2), folded where the ends of the string meet, removed, and measured on a centimeter rule It will be recalled that line 0 on the pelvimeter (Fig 1) is a true centimeter scale, reading up to 20 5 cm Since in all but the smallest fetuses, the uncorrected perimeter will exceed 20 5 cm , the length obtained by measuring it with the adhesive string is divided by two to obtain the uncorrected half perimeter The hair line of the slide is placed over the uncorrected half perimeter value and the corrected half perimeter is read on the line corresponding to one-half the external bitrochanteric diameter This is doubled to

give the total corrected perimeter value as seen in the lateral film

On the *lateral film* the pelvimeter pointers are placed at the points G and G′ (Fig 2) and the "new correction factor" is read on the line corresponding to one-half the bitrochanteric diameter, reading to the *nearest whole number* The uncorrected perimeter as seen on the anteroposterior film (Fig 3) is measured with the piece of adhesive string as above The uncorrected value is again divided by two to give the uncorrected half perimeter The hair line is placed over this value on line 0 of the pelvimeter, and the corrected half perimeter value is read on the horizontal line corresponding to the "new correction factor" just obtained from the lateral film

For example Suppose the external bitrochanteric diameter is 32 cm , the correction factor for the lateral film would be 16 The pelvimeter pointers would be placed at points G and G′ (Fig 2), and the "new correction factor" read on line 16 Assume that this reads 11 8 or, to the nearest whole number, 12, then, 12 is the "new correction factor " Say that the perimeter measured with the piece of rolled adhesive on the *anteroposterior film* is 35 6 cm , one-half of this would be 17 8 cm The hair line on the slide (Fig 1) is placed over 17 8 on line 0 On line 12 the corrected half perimeter is read as 14 8 cm This is doubled to get 29 6 cm as the total perimeter for the anteroposterior view

The corrected perimeter values obtained from the lateral and anteroposterior views are averaged to obtain the *average fetal head circumference* Two centimeters is usually added to this value to allow for the thickness of the fetal scalp The pelvimeter is turned over, and the volume corresponding to the average circumference is read from the table on the back

If the head is in a true anteroposterior or transverse plane, the cardinal fetal head measurements (the suboccipito-bregmatic, bi-parietal, and occipito-frontal diameters) can be obtained, the correction factors for these being identical to those used for obtaining the corrected perimeter in each view

CONCLUSIONS

A simple pelvimeter has been presented and the method of using it with the triangulation method of pelvimetry is discussed This represents a simplification of the Snow method The use of this pelvimeter has resulted in considerable time saving and increased accuracy by elimination of some steps in the usual method of correcting pelvic diameters and the fetal head measurements In addition to these advantages, *wet film readings* of pelvic diameters are readily obtained, since the readings are made directly from the films with the use of this pelvimeter

NOTE The writer wishes to express his thanks to Ray A Carter, M D , Chief Radiologist, Los Angeles County General Hospital, for his suggestions and to Mr Gerad Liefchild, R T , Chief Technician, Department of Radiology, Los Angeles County General Hospital

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SUMARIO

Sencillo Pelvimetro para la Pelvimetria Triangular

Descríbese un pelvímetro sencillo, explicándose la técnica para emplearlo con el método de triangulación en pelvimetría, lo cual representa una simplificación del metodo de Snow El empleo de este pelvímetro ahorra considerable tiempo y acrecienta la exactitud por eliminar algunos pasos de la técnica corriente de rectificar las mediciones de los diámetros de la pelvis y la cabeza del feto Además de estas ventajas, permite hacer fácilmente lecturas de los diámetros pelvianos en la película húmeda, en la cual se hacen directamente con este pelvímetro

EDITORIAL

Radiology and the Practice of Medicine

Presidential Address, Thirty-Third Annual Meeting
Radiological Society of North America[1]

IN THESE DAYS of political confusion and, indeed, of confusion of thought generally, it is not surprising to find the practice of radiology, if not misrepresented, at least misunderstood The complexities of modern social and economic forces have magnified the problems created by the phenomenal advancement of this specialty and rendered more urgent the question of its role and status in modern medicine

Generically, radiology is defined as the science of radiant energy and radiant substances Specifically, as it applies in the practice of medicine, it may be defined as the science and art of application of radiant energy and radioactive substances in the diagnosis and treatment of disease

My thesis is a simple one Is the practice of radiology the practice of medicine? If the answer is in the affirmative, what should be the relation of radiology to the patient, the hospital, and medical service plans?

Some states apparently attempt to define the practice of medicine by statute Others provide in substance that no one shall practice medicine without a license and have left the matter of definition to the courts The Supreme Court of Rhode Island has stated that "the 'practice of medicine' as ordinarily or popularly understood has relation to the art of preventing, curing or alleviating disease or pain It rests largely in the sciences of anatomy, physiology and hygiene It requires a knowledge of disease, its origin, its anatomical and physiological features and its causative relations, and, further, it requires a knowledge of drugs, their preparation and action Popularly, it consists in the discovery of the cause and nature of disease, and the administration of remedies or the prescribing of treatment therefor"

The law provides that a person practises medicine within the meaning of that act who holds himself out as being able to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity, or physical condition It further provides that no person shall practise medicine unless registered or licensed as therein provided

Similarly, the highest court of Texas has held that "the 'practice of medicine,' as contemplated and defined by law, is not restricted to treatment of diseases and disorders of the human body by use of drugs or surgery"

It is clear that before one may hold himself out as a radiologist he must be licensed to practise medicine, since the tools of his specialty are employed to diagnose and treat disease, the very essence of the practice of medicine For some years this was reversible No longer does the mere possession of radium or x-ray apparatus qualify one as a radiologist

In 1925, the American Medical Association established a section of Radiology, and in 1931 the Council of that Association began the listing of approved radiologists As a protection to the public, the profession in general, the radiologists themselves, representatives from the five nation-wide radiologic organizations, the Section on Radiology of the A M A, the American Roentgen Ray Society, the Radiological Society of North America, the American College of Radiology, and the American

[1] Delivered December 1, 1947, in Boston, Mass

Radium Society met in Milwaukee in 1933 and agreed unanimously that a specialty Board in Radiology be established

The American Board of Radiology was incorporated, organized, and held its first meeting in Washington, D C , in May 1934 and was accepted for membership in the Advisory Board for Medical Specialties and approved by the Council on Medical Education and Hospitals of the A M A The list of diplomates of the Board replaced the Council's list of approved radiologists and the latter was discontinued

Among the expressed purposes of the Board are these "To encourage the study and promote and regulate the practice of radiology" and "determine the competence of specialists in radiology" To each candidate who meets the requirements of the Board, a certificate is issued This may take one of two forms (1) a certificate to the effect that the applicant has been found qualified to practise radiology in all its branches, (2) a certificate to the effect that the applicant has been found qualified to practise radiology in one or more of the following special fields (a) roentgenology, (b) diagnostic roentgenology, (c) therapeutic radiology

Before qualifying for examination, each applicant is required to present evidence that he has met definite standards, among which, after the completion of an internship, shall be a period of special training in radiology of not less than three years in approved clinics, hospitals or dispensaries which shall comprise an active residency of not less than twenty-four months, with graduate training in pathology, radiation physics, and radiobiology

It is noteworthy that the Board states "Any radiologist who is practising radiology honorably and efficiently should have no difficulty in obtaining a certificate This Board has been organized, not to prevent qualified radiologists from obtaining certificates but to assist them in becoming recognized in their communities as men competent to practise in the special field of radiology"

Since radiology then has reached the honorable status of a medical specialty, is it good sense to attempt to decry it as a hospital service, a laboratory service, or a mere ancillary service? That hospital management and certain medical service plans, in wishful thinking, call it any one or all of these, does not make it so

By definition, a hospital is an institution in which patients are given medical or surgical care It has never been contemplated as an agency which provides medical and surgical services A laboratory is defined as a place devoted to experimental study in any science or a place where something is prepared or some operation performed It is as logical to describe the operation done by a surgeon in the operating room as a laboratory service as to describe the functioning of the radiologist as such If by ancillary service is meant auxiliary or helpful service applicable to any specialized field in medicine, radiology can accept the appellation If the term is used, as it often is, to minimize the importance of radiology in the diagnosis and treatment of disease, it can well be left to our fellow practitioners for refutation

Because so much radiology is practised in hospitals, custom has described it as a hospital service The hospital administrator desires to have it remain such to enable him, among other things, to control the income from it ' One argument often presented is that the hospital supplies the patient to the radiologist and, therefore, should control the fees, although the same argument is not offered when patients are rotated among the surgeons or medical staff

Again, it is loosely said that the hospital radiologist has a monopoly If by that is meant the exclusive control of a service that enables him to raise the price of the service materially above the price fixed by free competition, the argument falls of its own weight Fees for radiology are established, like all other medical fees, at a level sufficient to give a conscientious and competent practitioner a fair income for the amount of work he can do and do well enough to give the patient his money's

worth If one radiologist earns an inordinate sum from the net income of his practice in a hospital, then he is doing more work than one man can do well Two, three or perhaps more qualified radiologists are required to assist him The same applies to surgeons, internists, and other specialists

The peripatetic radiologist who "reads" films at several hospitals, no matter how much deplored, will continue to flourish while we have 6,280 approved hospitals and only 2,477 certified radiologists

Radiology—x-rays is the term sold to the public—has been used as a bait by so-called non-profit insurance companies to sell contracts The "non-profit" character of these organizations is "window dressing," meaning only that no dividends are paid to stockholders It does not mean that the company does not make a profit or pay very profitable salaries to its personnel It does mean, however, that it pays no government taxes as against the regular insurance companies, which yearly pay millions

The cost of x-ray services has been presented to the public as beyond the means of the average person Forget for the moment the totalitarian theory that the State should care for us from the cradle to the grave Let us look at the actual cost of radiological service in hospitals Despite the overload of x-ray examinations resulting from medical service plans, in the period 1936 to 1945 the average patient day cost in hospitals increased from $4 62 to $6 14 During the same period, the costs for the average x-ray department per patient day increased only 2 cents, from 21 cents to 23 cents These figures come from a recently published survey made by the Division of Rural Health of the Commonwealth Fund

Consider now the cost of radiology in some medical service plans Here, the figure varies according to the benefits offered If the maximum is $15, the ratio of x-ray costs to other costs will be less than if the maximum is $35 or if there is no maximum limit whatever In the Michigan Medical Service Plan (which is largely a surgical care plan) diagnostic x-ray services up to $15 per year are included among benefits Last year, 18 4 per cent of the 840,000 subscribers received x-ray services Of total payments to physicians, 5 per cent was for x-ray services The cost per subscriber per year for x-ray services amounted to twenty-nine cents

Group Hospital Service of Delaware covers both surgical benefits and hospitalization Diagnostic x-ray services are included up to $15 per year Last year 30 per cent of the subscribers received x-ray services, and 10 per cent of all payments made to physicians was for x-ray services

In California Physicians Service, x-ray examinations are covered for surgical cases, without any maximum For the last recorded year, 18 per cent of the premium income was expended for diagnostic x-ray services

These figures do not sustain the contention that radiology is a substantial part of hospital costs or that, under medical service plans, radiological charges are inordinate In truth, for the most part, the radiological work done in hospitals, under medical service plans that require hospitalization, could be performed in the private office of the radiologist just as efficiently and without prejudice to properly operated medical service plans

In certain hospitals, there have been deliberate efforts to increase the number of ambulatory patients in the outpatient service of the x-ray department for the frank purpose of increasing the hospital's profits from services rendered by the radiologist This trend has not affected radiologists only Except for city institutions, the charitable hospital is no longer with us Indeed, "charitable" was taken out of the incorporated name of one Boston hospital Outpatient departments in competition with the general practitioner, charging $1 50 and $2 00 a visit, are common today Pay clinics with fees of five, ten, and fifteen dollars compete with the internist in private practice

Ironically enough, one hospital account-

ing consultant "has advised hospitals (in a report soon to be published) that those specialists who maintain a practice in an outside office in the same community are in competition with the hospital they serve" Like some other spokesmen for the organized hospital world, this writer has assumed that certain medical procedures are the natural and proper functions of the hospital

The question once again presents itself Shall hospital corporations be permitted to practise medicine and to realize a profit from the services rendered by licensed physicians in the hospital? We are concerned here with the legitimate and proper functions of hospitals in relation to the practice of medicine by licensed physicians In this connection, we are particularly concerned with contractual arrangements between hospital corporations and licensed physicians who practise in the hospitals owned and operated by such corporations

Two clearly defined questions of law present themselves in a consideration of the practice of medicine in or by hospitals (1) Is an incorporated hospital which employs a physician on a salary or other stipulated compensation, the corporation itself charging and collecting fees for the physician's services, engaged in the practice of medicine? (2) If the answer to the first question is affirmative, is such practice unlawful?

These questions have been the subject of considerable debate in medical and hospital circles In a long line of cases, the courts have answered the two hypothetical questions set forth above in the affirmative [2]

Some hospital spokesmen seek to brush this aside by saying that the physicians themselves are licensed and it is they who perform the actual services, not the hospital But the courts have made no such distinction A corporation which acts through salaried agents acts itself This doctrine is so firmly settled in our jurisprudence that it is expressed by a Latin maxim *Qui facit per alium, facit per se*

Another rationale has been advanced by those who would justify the practice of medicine by hospitals They contend that charitable hospitals are exempt from the prohibitions of the medical practice act This is a question that has never been precisely adjudicated We can rest upon the fact that so far the courts have made no distinction between corporations for profit and those not for profit when interpreting statutes regulating the practice of medicine

The validity of the principles of the medical profession, however, are not based solely upon the law These principles were erected to preserve the highest standards of medical practice and to protect the welfare of the patient Among other things, they require that no third party, individual or corporation, shall be interjected between the patient and the attending physician or specialist who renders service to him

In a long series of resolutions adopted by the House of Delegates of the American Medical Association over a period of many years, the objections of the medical profession to the tendency for hospitals to engage in the practice of medicine have been forcibly stated Typical is the following, adopted by the House of Delegates at its annual meeting in 1942

"WHEREAS, Evidence of continued encroachment of hospitals into practice of medicine are manifest in numerous group hospitalization plans which offer certain medical services on a service basis as a part of hospital care and in plans adopted by numerous hospitals which include certain medical services in an 'all inclusive' per diem rate for hospital care, now therefore be it

"RESOLVED, That the House of Delegates reaffirms the principles enunciated in official resolutions over a period of many years opposing the practice of medicine by corporations or the interjection of a third party into the personal relationship and financial transaction between doctors and patients, and be it further

"RESOLVED, That hospital corporations should not be permitted to engage in the practice of medicine through the medium of employed physicians or to enter into contracts with any individual, group or

[2] See Bulletin of the Inter-Society Committee for Radiology The Employment of Physicians by Hospitals by Mac F Cahal Radiology 37 237, 377 507 1941

agency whereby the hospital agrees to furnish any medical services, and be it further

"RESOLVED, That, to the end that hospitals be discouraged from offering the services of licensed physicians to patients on a contract or service basis, all fees for medical services rendered in hospitals should be collected by or on the account of the physician rendering such service, and all physicians concerned in the care of a patient should give or send directly to the patient or other responsible party a statement, showing charges for professional services rendered, provided, however, that an exception to the foregoing principles may be made in the case of a formally organized partnership of physicians which acts in the capacity of an individual, and be it further

"RESOLVED, That the definitions of medical service and hospital service as applied to the principles stated herein shall be consistent with those applied in previous declarations of the House of Delegates in which medical services are construed as the services rendered by licensed practitioners of medicine, and hospital service as limited to hospital accommodations such as bed, operating room, medicines, surgical dressings, and general nursing care, and be it further

"RESOLVED, That the Board of Trustees be urged to proceed to the clarification of these problems as requested by the House of Delegates at its last annual session"

The following resolutions were adopted by the House of Delegates of the Association at its annual session in June 1947 and sent to all hospitals on the approved list of the Council on Medical Education and Hospitals

"RESOLVED, That the House of Delegates of the American Medical Association is in complete agreement with the recommendations of the West Virginia State Medical Association in its opposition to the encroachment by hospitals and other organizations on the private practice of medicine, and be it further

"RESOLVED, That all fees for medical services be set by and collected by or for doctors of medicine rendering this service, and that all policies and practices involving medical services be approved by the medical board or medical staff before being put into effect, and be it further

"RESOLVED, That the Council on Medical Education and Hospitals recommend strongly that all hospitals conform to these resolutions, and be it further

"RESOLVED, That the House of Delegates of the American Medical Association go on record as strongly disapproving this practice of encroachment, and that notice of this action be sent to the American Protestant and Catholic hospital associations and to the Blue Cross organizations"

We must recognize, and grant, that the practical application of these principles established by law and by resolution of the medical profession raises difficult and complex questions These questions can be settled, however, to the benefit of the patient's welfare—which is of course paramount—if the two parties involved, physicians and hospitals, will approach the issue with a tolerant and co-operative view This has been attempted here in Massachusetts

A committee representing the Massachusetts Hospital Service, the Massachusetts Medical Service, the Massachusetts Hospital Association, the specialties of radiology, pathology, anesthesiology, and the Massachusetts Medical Society met around the conference table this past Summer and reported as follows

"This committee has been asked to define hospital services and medical services and to establish the proper relations between physicians and hospitals

"In attempting its task the committee is well aware of the fact that conditions may properly vary in different localities and in different institutions, that the practice of medicine is undergoing rapid changes under unusual stresses, and that the concepts of tomorrow may vary markedly from those of today

"There are, however, certain fundamental principles that should not change if the profession of medicine is to discharge its obligation to society on an increasingly high level

"First, we accept the principle that the primary object of medical practice is to deliver the best possible care to the patient Second, we believe that this objective can best be attained by an independent and unfettered profession, conscious of its ideals and its responsibilities

"These principles are basically defined in Chapter III, Article VI, Section 5, of the Principles of Medical Ethics of the American Medical Association.

"It is unprofessional for a physician to dispose of his professional attainments or services to any lay body, organization, group or individual, by whatever name called, or however organized, under terms or conditions which permit a direct profit from the fees, salary or compensation received to accrue to the lay body or individual employing him Such a procedure is beneath the dignity of professional practice, is unfair competition with the profession at large, is harmful alike to the profession of medicine and the welfare of the people, and is against sound public policy

"Nothing in this report refers to interns, residents, or fellows The committee is aware that his problem deserves separate consideration.

"In accordance with these principles your committee submits the following definitions and recommendations

I Services Rendered in Hospitals

"A Non-Medical Hospital Services

"Non-medical hospital services are defined as those services, technical and non-technical, provided by other than a registered physician, which are required for the care of the patients, the making of a diagnosis and the treatment and prevention of disease, and those services rendered by a registered physician in an administrative capacity or as the head of a department when such services do not include the obtaining or interpretation of information in behalf of an individual patient

"These shall be considered to include the following

1 Administration
2 Nursing
3 Social Service
4 Record Room and Library
5 Pharmacy
6 Dietary Service
7 Housekeeping and Laundry
8 Maintenance of building and grounds, including the provision, maintenance, repair and replacement of technical equipment and supplies
9 Provision of technical and non-technical personnel and their qualified supervision
10 Reports without interpretation from the clinical laboratories
11 Such other service as may be necessary for the operation of a hospital

"B Medical Hospital Services

"Medical hospital services are defined as those services other than administrative, rendered by a registered physician directly or indirectly to or in behalf of an individual patient for the obtainment and interpretation of data, including consultation and advice, for the diagnosis, treatment and prevention of disease Such services will embrace the general and special practice of medicine, surgery, and obstetrics, and the practice of the related specialties including anesthesiology, physical medicine, radiology, pathology and clinical pathology including bacteriology, clinical chemistry and other clinical laboratory specialties

"It is accepted as a basic principle of good medical practice that a professional interpretation should accompany the report on radiological examinations and on materials and tissues examined by the pathologist

II The Establishment of Proper Relations Between Physicians and Hospitals

"To establish principles governing the proper relations between physicians and hospitals, your committee makes the following recommendations

"1 That the medical costs of hospital care be separated from the non-medical costs, as can be done by existing and accepted methods of cost-accounting, and that they appear thus separated on the statement submitted to the patient

"2 That bills for all medical services be rendered in the name of the physician or physicians performing the services

"3 That a basic principle in the establishment of charges should be that each department be self-supporting This principle should be so applied that neither the hospital nor the physician rendering the service will exploit the patient or each other

"4 That fees for medical services which are collected by the hospital be established by joint action of a representative committee of the staff and the governing body of the hospital and including also the head of the department and the administrator

"5 That the basis of financial arrangement between hospital and physician may be salary, commission, fees, or such other method as will best meet the local situation, with due regard to the needs of the patient, the community, the hospital, and the physician

"It is the opinion of the committee that acceptance and practice of these principles will clarify the confusion that now exists regarding responsibility for the payment of medical hospital services and non-medical hospital services, as defined above, by prepayment and other insurance plans"

This report of the committee to study special services was submitted to the Council of the Massachusetts Medical Society and unanimously adopted Inasmuch as representatives of the Massachusetts Hospital Association, the Blue Cross and Blue Shield aided in the formulation of these principles and signed the report to the Council, it is anticipated that with the adoption of the report by the Council every reasonable effort will be made on the part of hospitals and medical service plans to implement its recommendations

In recent years especially, we have heard of the socialization of industry, of finance, and of medicine Socialization is a leveling process It takes from those who have to give to those who have not Governments do it by taxation Individuals and corporations whose activities show profits are taxed and the taxes are applied to running the government, particularly to doing things for those who cannot do for themselves This has resulted in business interests being unable to keep the profits they feel they have justly earned by their labors There has been much bewailing on the part

of business men over the injustice of this These men tell us that the American way of life is threatened, that in depriving private enterprise of the profit-motive the stimulation which built this country is being destroyed There is truth in this

But the very men who as financiers and industrialists oppose governmental socialization, as laymen on Boards of Trustees and managers of hospitals, medical schools and insurance schemes, blindly or not, attempt to apply to medicine the principles they condemn in their own particular sphere of activity

In his new book, "Ghandi and Stalin," Louis Fischer contrasts the two personalities, the one a spiritual force, the other an autocrat The author dwells on the evil of concentrated authority How to curb power is the basic problem of human relationships He points out that great concentrations of capital may threaten the liberties of the people but the transfer of all power from capitalists to government results in an unassailable despot We do not want either

We are truly living in an era of political romanticism, as exemplified by our left wing individuals who call themselves liberals As Thomas Woodlock says, they fight under the banner of liberty Yet, they are all at heart, consciously or unconsciously, for the totalitarian state, which is liberty's most deadly enemy They are all for justice, yet, who are more unfair in their concepts of what is just?

Read the story of the Spartan state under Lycurgus, as related by Plutarch, to realize that totalitarianism did not begin with Hitler Let us hope it will end with Stalin

The socialization of medicine is part and parcel of totalitarianism Granting that changes in the economics and technics of medicine may lead to changes in the functions of hospitals, there can be no compromise on one fundamental principle Doctors must not become pawns in an autocratic nation-wide plan envisaged either by government or by hospital or insurance associations

FREDERICK W O'BRIEN, M D

SIXTH INTERNATIONAL CONGRESS OF RADIOLOGY

The radiologists of Great Britain, through their National Radiological Committee, have invited the Sixth International Congress to meet in London in the year 1950 The invitation has been accepted by the International Executive Committee and the Congress will be held either in July or September of that year, the exact date to be determined later

Dr Ralston Paterson of Manchester, England, will be the President of the Congress

JOINT SCIENTIFIC SESSION, SECTIONS ON RADIOLOGY AND PREVENTIVE AND INDUSTRIAL MEDICINE AND PUBLIC HEALTH, A M A

The Section on Radiology and the Section on Preventive Medicine and Public Health of the American Medical Association will hold a joint scientific session on June 25, in Chicago This will be in the form of a symposium by clinicians and chemists who have been especially interested in the diagnosis, treatment, and prevention of pulmonary lesions occurring in workers in certain industries

Pulmonary affections of occupational origin have interested the radiologist for many years Likewise, for many years, it has been held that the only substances apt to produce a disabling fibrosis were silica and asbestos It was especially felt that practically all silicates were relatively inert Recently, however, it has come to light that peculiar pulmonary lesions have occurred among bauxite workers, diatomaceous earth workers, and among those exposed to beryllium or its acid radicals

In order to bring the latest information regarding these from experienced radiologists, clinicians, and pathologists, the Section on Industrial Medicine of the American Medical Association has invited the Section on Radiology to a joint session The purpose of this notice is to call this to your attention, for it portends an extraordinary symposium

R T JOHNSTONE, M D,
Secretary, Section on Preventive and Industrial Medicine and Public Health

U V PORTMANN, M D,
Secretary, Section on Radiology

THE AMERICAN RADIUM SOCIETY

A program of unusual interest is promised for the annual meeting of the American Radium Society for June 20–22, 1948, at the Hotel Stevens, Chicago The Program Committee has invited a number of foreign guests who will report on recent advances in European radiotherapy, which information was inaccessible to Americans during the war years The following have already promised to present reports on radium and x-ray treatment of cancer Francois Baclesse and Juliette Baud of the Curie Foundation, Paris, the former in charge of roentgen therapy, the latter of radium therapy, Ellis Berven, Professor of Radiotherapy at the University of Stockholm and director of the Radiumhemmet, Sir Stanford Cade of London, who has written a most informative book on Radium and Cancer, Brian Windeyer, Professor of Radiotherapy at the University of London, and director of the Meyerstein Institute of Radiotherapy of the Middlesex Hospital, London, Constance Wood, Director of Radiotherapeutic Research Unit of the British Medical Research Council, in charge of Radium Beam, Dr R McWhirter, Director of Radiology, Royal Infirmary, Edinburgh, Scotland, who has treated 2,500 patients with cancer of the breast with local mastectomy and postoperative x ray therapy A number of equally eminent American radiotherapists will participate An oration on the discovery of radium will be delivered by Dr Edith Quimby at the banquet The Janeway Lecture, Monday afternoon, on the "Achievement of Radium in the Fight Against Cancer," will be given by Sir Stanford Cade Panel discussions on the treatment of cancer of the tongue, cancer of the breast and "Should Radiotherapy Be Separated from X-ray Diagnosis," as well as individual papers, will be given Monday and Tuesday Special Refresher Courses will be conducted by the foreign guests Sunday morning preceding the regular sessions

Those interested will find it advantageous to write immediately to Stevens Hotel, Chicago, Ill, for reservations and to Dr Maurice Lenz, Chairman Program Committee, 840 Park Avenue, New York 21, N Y, for further information regarding Refresher Courses

AMERICAN BOARD OF RADIOLOGY

Heretofore the American Board of Radiology has demanded that all candidates admitted to examination should be graduates of an approved Class A medical school The Board has recently ruled, however, that those who have graduated from foreign and substandard medical schools before 1947 may be admitted to the examination if and when they have complied with the other requirements of the Board No candidate who graduates from a substandard school (foreign or domestic) after 1947 will be admitted to the examination

The Board has also ruled that a maximum credit of six months toward the required three years training may be allowed for formal didactic courses in the basic sciences.

Many candidates who have applied for the entire

field of Radiology or Roentgenology and who pass the examination in Diagnostic Roentgenology, or possibly in Therapy, ask for a limited certificate in the field in which they have passed, expecting to reapply shortly for re-examination in the other field This they are entitled to do, but in order to discourage candidates taking partial certificates, the Board has ruled that two years must elapse after a candidate accepts a certificate in one field before he may apply for additional certification

LOUISVILLE RADIOLOGICAL SOCIETY

At the December meeting of the Louisville Radiological Society, Dr Joseph C Bell was elected Chairman of the Society and Dr Everett L Pirkey was re-elected Secretary and Treasurer

Dr Bell also assumed, in January, the office of President of the Jefferson County (Kentucky) Medical Society

XIMIE RICHARD HYDE HONORED

Dr Ximie R Hyde, a member of the Radiological Society of North America, has recently assumed office as president of the Tarant County (Texas) Medical Society He is a past president of the Texas Radiological Society

NATIONAL ADVISORY CANCER COUNC IL

The appointment of two of the country's leading men of science to the National Advisory Cancer Council of the National Cancer Institute, U S Public Health Service, was recently announced The new members of the Council are Dr Edward A Doisy of the St Louis University School of Medicine and a Nobel Prize winner in Medicine in 1943, and Dr John J Morton, Jr, of the University of Rochester (New York) School of Medicine and Dentistry

Present members of the Council are Dr Charles Huggins of the University of Chicago School of Medicine, Dr Robert S Stone of the University of California, Department of Radiology, Dr Shields Warren of the Harvard Medical School, and Dr Waltman Walters of the Mayo Clinic and the University of Minnesota School of Medicine Dr A C Ivy, who is Vice-President of the University of Illinois, is Executive Director of the Council Dr Thomas Parran, Surgeon General, U S Public Health Service, acts as Chairman

APPOINTMENT OF OFFICERS IN THE MEDICAL CORPS OF THE REGULAR NAVY

The statutory authority contained in Public Law 365—80th Congress, Title II (Army-Navy-Public Health Service Medical Officer Procurement Act of 1947) now makes it possible for civilian doctors to become commissioned officers in the regular Navy, provided they meet the professional and physical qualifications This law for the first time does away with the age limitation of thirty-two years and permits doctors in civilian practice to enter the Navy and be commissioned with rank up to and including Captain The law considers all strata of the medical profession, interns, residents, reserves, former medical officers who have resigned, and present practising physicians

In order to make application, a doctor must be a citizen of the United States, a graduate of a Class A medical school, and have served at least one year's internship in an approved hospital Candidates will then be judged on a number of qualifications, such as membership in a specialty board, teaching connections, number of years of professional or scientific practice, hospital or laboratory connections, military service, etc The allocation of rank to successful candidates will depend upon their academic age, professional standing, and experience in the medical field They will be eligible for promotion along with their fellow officers of equal rank.

Men who are interested should write to the Bureau of Naval Personnel, *via* the Bureau of Medicine and Surgery, Navy Department, Washington, D C

GENERAL ELECTRIC X-RAY CORPORATION

Of interest to radiologists will be the announcement by the General Electric X-Ray Corporation of the removal of its main offices, laboratories, and manufacturing plant from Chicago to 4855 West McGeoch Ave, Milwaukee, Wis

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender Reviews will be published in the interest of our readers and as space permits

THE MEDICAL ANNUAL, 1947 A YEAR BOOK OF TREATMENT AND PRACTITIONER'S INDEX Editors SIR HENRY TIDY, K B E, M A, M D (Oxon.), F R C P, and A RENDLE SHORT, M D, B S, B Sc, F R C S A volume of 464 pages with numerous illustrations reproduced from the papers reviewed Published by John Wright & Sons Ltd, Bristol, and Simpkin Marshall (1941) Ltd, London

Book Reviews

DISEASES OF THE CHEST WITH EMPHASIS ON X-RAY DIAGNOSIS By ELI H RUBIN, M D, F A C P, F C C P, Attending Physician, Division of Pulmonary Diseases, Montefiore Hospital and Country Sanatorium, New York, Visiting Physician in Tuberculosis and Physician in-charge, Chest Clinic, Morrisania City Hospital, New York A volume of 685 pages, with 355

illustrations (24 plates in color) W B Saunders Co, Philadelphia and London, 1947 Price $14 50

Dr Eli Rubin has written a book on *Diseases of the Chest* from the point of view of the modern clinician who realizes that such a work without strong emphasis on the roentgen aspects is of little value His text is divided into six sections and these into numerous chapters

Section I is composed of four chapters taking up, respectively, the fundamental aspects of anatomy as related to roentgenology, technical considerations of roentgenology, physiology, and symptoms and signs of lung disease Section II includes six chapters, on the acute and chronic pneumonias In dealing with these diseases, the clinical features relating to the etiology, pathology, symptoms and signs, and treatment are outlined, in addition to the roentgen signs One chapter is devoted to chemotherapy Section III, comprising eight chapters, is devoted to pulmonary tuberculosis The clinical and roentgenologic aspects of the various types of tuberculous involvement are detailed, there is a chapter on complications, one on rest and pneumothorax, and one on surgical measures The nine chapters making up Section IV describe chronic non-tuberculous diseases of the lungs and bronchi with special attention to bronchial obstruction One chapter is devoted to pulmonary neoplasms Section V (six chapters) covers diseases of the mediastinum, diaphragm, and pleura, and related structures, including heart-lung disease One chapter is devoted to neoplasms of the mediastinum

The principles of surgical treatment are discussed in Section VI (four chapters) This discussion, the work of Dr Morris Rubin, is relatively general, to acquaint the reader with some of the possibilities of chest surgery without elaborate technical details

The author states that the book is designed for use by general practitioners, sanatorium physicians, medical students, and radiologists This last group will find, to their advantage, rather more clinical background material combined with the radiological aspects than is usual in purely radiologic texts The book is recommended as a valuable addition to our present roentgen literature

CHRONIC STRUCTURAL LOW BACKACHE DUE TO LOW-BACK STRUCTURAL DERANGEMENT By R A ROBERTS, B Sc, M B, Ch B, D M R E A volume of 105 pages, with 137 illustrations on 46 plates Published by H K Lewis & Co, Ltd, London, 1947 Price 45s net

In *Chronic Structural Low Backache Due to Low-Back Structural Derangement* we have a monograph restricted to the consideration of chronic lumbar back pain of purely mechanical origin secondary to developmental anomalies or trauma or both Attention is focused on the "pars interarticularis" or "isthmus" of the neural arch This segment is described as a relatively delicate but structurally important pivotal center in motion between the vertebrae It has been subjected to even greater stress by man's assumption of the erect position Abnormalities are difficult to recognize roentgenographically unless oblique views in the standing position are taken

Backache of the type under discussion is classified according to the nature and number of demonstrable radiologic findings, ranging from spondylolisthesis to ossification defects to no visible change at all

In contrast to developmental anomalies and fractures of the "isthmus," the author describes a "strain deossification"—a different concept—wherein he postulates a demineralization instead of an eburnation resulting from abnormal stress or pressure This results in relaxation of the supporting ligamentous structures and produces a "flail joint" or instability It may be that one cannot accept immediately all of the ideas promulgated, but in the present day enthusiasm of the proponents of intervertebral disk injuries, this carefully prepared volume will make one pause before searching for a suspected protruded disk without objective corroborative evidence

On the whole, the author presents a good case to support his contention His plea for complete roentgenographic studies should be heeded by those who see and treat chronic back complaints

Numerous illustrative case reports with a series of roentgenograms and well executed diagrams are presented An extensive bibliography is included with references to works by anatomists, orthopedists and roentgenologists

AN INTRODUCTION TO BIOCHEMISTRY By WILLIAM ROBERT FEARON, M A, Sc D, M B, Fellow of Trinity College, and Professor of Biochemistry, University of Dublin, Fellow of the Royal Institute of Chemistry, Member of the Royal Irish Academy A volume of 569 pages Published by Grune & Stratton, New York, 3d edition, 1947 Price $6 00

Fearon's well known *Introduction to Biochemistry*, from Ireland, now appears in its third edition considerably revised and with several new sections consistent with the latest developments since 1940 Additional emphasis has been placed on subjects of special interest in clinical medicine, as, for example, acid-base balance, animal calorimetry, bone formation, food adsorption, detoxication, tissue chemistry, and nutrients As a result, a tremendous amount of information is condensed into this single volume, well documented with the best series of general references to be found in any similar text There is excellent writing, as is so frequently true of contributions from the British Isles

The reader has somewhat of a sense of confusion, however, which is perhaps to be expected from the full coverage and condensation, in that the text is hardly adaptable for an elementary textbook be-

cause of certain advanced sections Neither is it well adapted for advanced courses because much of the material is entirely too elementary and the book could hardly be considered sufficiently adequate for a definitive reference work Several professors in biochemistry who have examined this text, at the request of the reviewer, have high praise for the effort and many parts of the presentation, but have generally expressed the feeling that it would be difficult to use in their University classes, particularly in many sections where the author plunges headlong into some of the most difficult and advanced modern technics However, with this fresh point of view, the book undoubtedly can be used to advantage in conjunction with additional textbooks or reference volumes

The printing appears to have been done by some sort of off-print method on only a fair grade of paper, and the rather flimsy binding easily gets out of shape There are a number of errors, particularly in formulas, which have escaped the proofreader, as for example, in the table on page 245

With the above mentioned reservations, it is very likely that this book will be a valuable addition to the library of biochemists and up-to-date teachers and research workers in clinical medicine

SELECTED PAPERS FROM THE ROYAL CANCER HOSPITAL (FREE) AND THE CHESTER BEATTY RESEARCH INSTITUTE, London, Vol IV, 1943–1944, comprising reprints of articles from various journals A volume of 381 pages Price 16/(£ 16s)

The selected papers published by the Staff of the Royal Cancer Hospital (Free) and the Chester Beatty Research Institute during the years of 1943 and 1944 cover a wide range of research and clinical work as seen in a cancer hospital and research laboratory, with abundant material on the physics of radiation as well as practical radiotherapy There are also articles on diagnostic roentgenology Many of the papers of radiologic interest have been abstracted in RADIOLOGY

The papers making up the volume have been printed by the "replika process," furnishing an exact reproduction of the original text and illustrations The paper is good and the binding of cloth is adequate for a book of this kind

RADIOLOGICAL SOCIETIES SECRETARIES AND MEETING DATES

Editor's Note Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates Address Howard P Doub, M D , The Henry Ford Hospital, Detroit 2, Mich

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA *Secretary Treasurer,* Donald S Childs, M D , 607 Medical Arts Bldg , Syracuse 2, N Y

AMERICAN RADIUM SOCIETY *Secretary,* Hugh F Hare, M D , 605 Commonwealth Ave , Boston 15, Mass

AMERICAN ROENTGEN RAY SOCIETY *Secretary,* Harold Dabney Kerr, M D , Iowa City, Iowa

AMERICAN COLLEGE OF RADIOLOGY *Secretary,* Mac F Cahal, 20 N Wacker Dr , Chicago 6, Ill

SECTION ON RADIOLOGY A M A *Secretary,* U V Portmann, M D , Cleveland Clinic, Cleveland 6, Ohio

Alabama

ALABAMA RADIOLOGICAL SOCIETY *Secretary-Treasurer,* Courtney S Stickley, M D , Bell Bldg Montgomery Next meeting at the time and place of the Alabama State Medical Association meeting

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY *Secretary,* Fred Hames, M D , Pine Bluff Meets every three months and annually at meeting of State Medical Society

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY *Secretary,* Sydney F Thomas, M D , Palo Alto Clinic, Palo Alto

LOS ANGELES RADIOLOGICAL SOCIETY (A SECTION OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION) *Secretary,* Moris Horwitz, M D , 2009 Wilshire Blvd , Los Angeles 5 Meets second Wednesday of each month at County Society Bldg

PACIFIC ROENTGEN SOCIETY *Secretary,* L Henry Garland, M D , 450 Sutter St , San Francisco 8 Meets annually with State Medical Association

SAN DIEGO ROENTGEN SOCIETY *Secretary,* R F Niehaus, M D , 1831 Fourth Ave , San Diego Meets first Wednesday of each month

X RAY STUDY CLUB OF SAN FRANCISCO *Secretary,* Ivan J Miller, M D 2000 Van Ness Ave Meets monthly on the third Thursday at 7 45 P M , January to June at Lane Hall, Stanford University Hospital, and July to December at Toland Hall, University of California Hospital

Colorado

DENVER RADIOLOGICAL CLUB *Secretary,* Mark S Donovan, M D , 306 Majestic Bldg , Denver 2 Meets third Friday of each month, at the Colorado School of Medicine and Hospitals

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY *Secretary,* Robert M Lowman, M D , Grace-New Haven Hospital, Grace Unit, New Haven Meetings bimonthly, second Thursday

Florida

FLORIDA RADIOLOGICAL SOCIETY *Secretary-Treasurer,* J A Beals, M D , St Luke's Hospital, Jacksonville Meets semiannually, in April, preceding the annual meeting of the Florida Medical Society, and in November

Georgia

GEORGIA RADIOLOGICAL SOCIETY *Secretary-Treasurer,* Robert Drane, M D , De Renne Apartments, Savannah Meets in November and at the annual meeting of State Medical Association

Illinois

CHICAGO ROENTGEN SOCIETY *Secretary,* T J Wachowski, M D , 310 Ellis Ave , Wheaton Meets at the Palmer House, second Thursday of October, November, January, February, March, and April, at 8 00 P M

ILLINOIS RADIOLOGICAL SOCIETY *Secretary-Treasurer,* William DeHollander, M D , St Johns' Hospital, Springfield Meetings quarterly as announced

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY *Secretary,* John H Gilmore, M D , 720 N Michigan Ave , Chicago 11

Indiana

INDIANA ROENTGEN SOCIETY *Secretary-Treasurer,* J A Campbell, M D , Indiana University Hospitals, Indianapolis 7 Annual meeting in May

Iowa

IOWA X-RAY CLUB *Secretary,* Arthur W Erskine, M D , 326 Higley Building, Cedar Rapids Meets during annual session of State Medical Society

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY *Secretary-Treasurer,* Sydney E Johnson, M D , 101 W Chestnut St Louisville

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary Treasurer,* Everett L Pirkey, Louisville General Hospital, Louisville 2 Meets second Friday of each month at Louisville General Hospital

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY *Secretary-Treasurer,* Johnson R Anderson M D , No Louisiana Sanitarium, Shreveport Meets with State Medical Society

ORLEANS PARISH RADIOLOGICAL SOCIETY *Secretary*, Joseph V Schlosser, M D , Charity Hospital of Louisiana, New Orleans 13 Meets first Tuesday of each month

SHREVEPORT RADIOLOGICAL CLUB *Secretary*, Oscar O Jones, M D , 2622 Greenwood Road Meets monthly September to May, third Wednesday, 7 30 P M.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION *Secretary*, Harry A Miller, 2452 Eutaw Place, Baltimore

Michigan

DETROIT X-RAY AND RADIUM SOCIETY *Secretary-Treasurer*, E R. Witwer, M D , Harper Hospital, Detroit 1 Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS *Secretary-Treasurer*, R B MacDuff, M D , 220 Genesee Bank Building, Flint 3

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY *Secretary*, C N Borman, M D , 802 Medical Arts Bldg , Minneapolis 2 Regular meetings in the Spring and Fall

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY *Secretary*, Wm M Kitchen, M D , 1010 Rialto Building, Kansas City 6, Mo Meetings last Friday of each month

ST LOUIS SOCIETY OF RADIOLOGISTS *Secretary*, Edwin C Ernst, M D , 100 Beaumont Medical Bldg Meets on fourth Wednesday of each month, October to May

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Ralph C Moore, M D , Nebraska Methodist Hospital, Omaha 3 Meetings third Wednesday of each month at 6 P M in either Omaha or Lincoln

New England

NEW ENGLAND ROENTGEN RAY SOCIETY *Secretary-Treasurer*, George Levene, M D , Massachusetts Memorial Hospitals, Boston, Mass Meets monthly on third Friday at Boston Medical Library

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY *Secretary-Treasurer*, Albert C Johnston, M D , Elliot Community Hospital, Keene Meetings quarterly in Concord

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY *Secretary*, Raphael Pomeranz, M D , 31 Lincoln Park, Newark 2 Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J Francis, M D , East Rockaway, L I

BROOKLYN ROENTGEN RAY SOCIETY *Secretary-Treasurer*, Abraham H Levy, M D , 1354 Carroll St , Bklyn 13 Meets fourth Tuesday of every month, October to April

BUFFALO RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Mario C Gian, M D , 610 Niagara St , Buffalo 1 Meetings second Monday evening each month, October to May, inclusive

CENTRAL NEW YORK ROENTGEN SOCIETY *Secretary-Treasurer*, Dwight V Needham, M D , 608 E Genesee St , Syracuse 10 Meetings in January, May, and October

LONG ISLAND RADIOLOGICAL SOCIETY *Secretary*, Marcus Wiener, M D , 1430 48th St , Brooklyn 19 Meetings fourth Thursday evening each month at Kings County Medical Bldg

NEW YORK ROENTGEN SOCIETY *Secretary*, Wm Snow, M D , 941 Park Ave , New York 28

ROCHESTER ROENTGEN-RAY SOCIETY *Secretary*, Murray P George, M D , 260 Crittenden Blvd , Rochester 7 Meets at Strong Memorial Hospital, third Monday, September through May

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA *Secretary-Treasurer*, James E Hemphill M D , Professional Bldg , Charlotte 2 Meets in May and October

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY *Secretary* Charles Heilman M D 1338 Second St N Fargo

Ohio

OHIO STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Carroll Dundon, M D , 2065 Adelbert Road, Cleveland 6 Next meeting at annual meeting of the State Medical Association, Cincinnati, March 31, 1948

CENTRAL OHIO RADIOLOGICAL SOCIETY *Secretary*, Edward T Kirkendall, M D , 700 North Park St , Columbus 8

CINCINNATI RADIOLOGICAL SOCIETY *Secretary*, Eugene L Saenger, M D , 735 Doctors Bldg , Cincinnati 2 Meets last Monday, September to May

CLEVELAND RADIOLOGICAL SOCIETY *Secretary-Treasurer*, George L Sackett, M D , 10515 Carnegie Ave , Cleveland 6 Meetings at 6 30 P M. on fourth Monday, October to April, inclusive

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY *Secretary Treasurer*, Peter M Russo, M D , 230 Osler Building, Oklahoma City Meetings three times a year

Oregon

OREGON RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Wm Y Burton, M D , 242 Medical Arts Bldg , Portland 5 Meets monthly, on the second Wednesday, at 8 00 P M , in the library of the University of Oregon Medical School

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY *Secretary Treasurer*, Sydney J Hawley, M D , 1320 Madison St , Seattle 4, Wash Meets annually in May

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, James M Converse M D , 416 Pine St , Williamsport 8 Meets annually

PHILADELPHIA ROENTGEN RAY SOCIETY *Secretary*, Arthur Finkelstein, M D Graduate Hospital, Philadelphia Meets first Thursday of each month at 8 00 P M , from October to May in Thomson Hall, College of Physicians, 21 S 22d St

PITTSBURGH ROENTGEN SOCIETY *Secretary-Treasurer*, R P Meader, M D 4002 Jenkins Arcade, Pitts burgh 22 Meets second Wednesday of each month at 6 30 P M October to June

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Maurice D Frazer, M D , Lincoln Clinic, Lincoln Nebr

South Carolina

SOUTH CAROLINA X RAY SOCIETY *Secretary-Treasurer*, Robert B Taft, M D , 103 Rutledge Ave , Charleston 16

Tennessee

MEMPHIS ROENTGEN CLUB Meetings second Tuesday of each month at University Center

TENNESSEE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, J Marsh Frére, M D , 707 Walnut St , Chattanooga Meets annually with State Medical Society in April

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB *Secretary*, X R Hyde, M D Medical Arts Bldg , Fort Worth 2 Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months

TEXAS RADIOLOGICAL SOCIETY *Secretary-Treasurer*, R P O'Bannon, M D 650 Fifth Ave , Fort Worth 4 Next meeting Jan 7-8, 1949

Utah

UTAH STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, M Lowry Allen, M D , Judge Bldg Salt Lake City 1 Meets third Wednesday, January, March, May, September, November

UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE *Secretary*, Henry H Lerner, M D Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital

Virginia

VIRGINIA RADIOLOGICAL SOCIETY *Secretary*, P B Parsons, M D , Norfolk General Hospital, Norfolk 7

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Homer V Hartzell, M D , 310 Stimson Bldg , Seattle 1 Meetings fourth Monday October through May, at College Club, Seattle

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY *Secretary-Treasurer*, A Melamed, M D , 425 E Wisconsin Ave , Milwaukee 2 Meets monthly on second Monday at the University Club

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY *Secretary* S R Beatty, M D , 185 Hazel St , Oshkosh Two-day meeting in May and one day at annual meeting of State Medical Society in September

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE Meets first and third Thursdays 4 to 5 P M , September to May, inclusive, Room 301, Service Memorial Institute 426 N Charter St , Madison 6

Puerto Rico

ASOCIACION PUERTORRIQUEÑA DE RADIOLOGIA —*Secretary*, Jesus Rivera Otero, M D , Box 3524, Santurce, Puerto Rico

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS *Honorary Secretary-Treasurer*, E M Crawford, M D , 2100 Marlowe Ave , Montreal 28, Quebec Meetings in January and June

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES *General Secretary*, Origéne Dufresne, M D , Institut du Radium, Montreal Meets on third Saturday of each month

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA Offices in Hospital Mercedes, Havana Meets monthly

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA *General Secretary*, Dr Dionisio Pérez Cosío, Marsella 11, México, D F Meetings first Monday of each month

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

The Musculoskeletal System

Gynecology and Obstetrics

The Genito-Urinary System

Sinus Tracts and Fistulas

RADIOTHERAPY

Technical Considerations

RADIOACTIVE ISOTOPES

EFFECTS OF RADIATION

THE HEAD AND NECK

The Three Types of Glioblastoma. Eduard Busch and Erna Christensen J Neurosurg 4 200–220, May 1947

In a series of 133 glioblastomas, significant differences were found in macroscopic and microscopic pathology, in the age of the patient at admission, in the length of the history, in cerebral localization, and especially in the period of postoperative survival The authors recognize three types of glioblastoma multiforme differing in the above-mentioned aspects and suggest the names glioblastoma angionecroticum, glioblastoma multicellulare, and glioblastoma magnocellulare In most of the cases the preoperative diagnosis was glioblastoma, with the usual percentage of error (subdural hematoma, abscess, metastasis), but it was found impossible to make a reliable "type-diagnosis" on the clinical symptoms alone

The only real help to a ' type-diagnosis" has been cerebral angiography Arteriovenous anastomoses were found in 21 of 33 angionecrotic glioblastomas, in only 1 of 24 multicellular tumors (and even then not quite typical), and in none of 17 patients with magnocellular glioblastoma The investigation is of help when positive, but fails in a certain number of angionecrotic tumors, presumably because no anastomoses are patent at the time of angiography The procedure has been of considerable assistance in making a decision as to operation in some patients whose general condition is poor If anastomoses are seen, the tendency is to discourage surgery The indication for operation, however, must in every case be an individual one. With experience, the differentiation of the three types can usually be made at operation Several times in the series, however, a multicellular glioblastoma was taken to be angionecrotic, but the angionecrotic type was never taken for anything else Glioblastomas of the magnocellular type have occasionally been mistaken for metastatic tumor, but are usually larger than the average metastasis

In their first cases, the authors tried to carry out lobectomies but they soon discontinued this procedure and made as clean an excision of the tumor alone as was possible without damaging important centers The operative mortality for the whole series was 23 3 per cent Of the patients who survived operation, all with angionecrotic glioblastoma were dead within a year and a half, nearly half of the multicellular and over half of the magnocellular groups were still living at the time of the report Postoperative roentgen therapy was given in most cases (3600 r in 15 daily doses) and when possible the series was repeated after three and six months While it is very difficult to judge the effect of radiation in these cases, the authors believe it is of definite value

Neurinomas of the Cerebellopontile Recess A Clinical Study of One Hundred and Sixty Cases Including Operative Mortality and End Results Antonio Gonzalez Revilla Bull Johns Hopkins Hosp 80 254–296 May 1947

This is a study of 160 neurinomas of the cerebellopontile angle seen at operation in a period of twenty years (1926–45) Only the roentgen observations will be summarized here

The great majority of the cases, 145, were unilateral acoustic neurinomas In every case where the diagnosis of an acoustic tumor was suspected, stereoscopic films of the base of the skull were taken in an attempt to visualize the porus acousticus Unfortunately, reports of the findings were available in only 114 cases Of these, 52 (50 per cent) showed either enlargement or definite destruction of the internal auditory orifice, 7 merely showed evidence of increased intracranial pressure as manifested by destruction of the sella turcica and increase in the convolutional markings Forty five cases showed no abnormalities

Air studies were rarely performed, being done in 8 cases where the diagnosis was in doubt Ventriculography was used in all of them In 5 of these the ventricles were markedly dilated with definite evidence of a block at the aqueduct of Sylvius In 1 case there was moderate dilatation of the ventricular system with no evidence of block or any other deformity In 2 cases the ventriculograms were completely normal showing small symmetrical ventricles with no evidence of obstruction In none of these cases could the deformity of the ipsilateral horn as described by Stone and Schulze (Am J Roentgenol 39 523 1938) be demonstrated

In the entire series there were only 3 cases of unilateral acoustic neurinoma with evidence of peripheral neurofibromatosis (1 8 per cent) In 2 of these cases x-ray studies showed marked destruction of the porus acousticus and in one they were negative. Air studies were not performed

Roentgen examination of the skull was reported in 4 of the 6 cases of bilateral tumor of the nervus acousticus. In 1 there was evidence of erosion of the porus acousticus on both sides Another showed unilateral erosion and the remaining 2 showed no apparent change. There were no air studies performed in any of this group

X-rays were taken in 2 of the 3 cases of neurinoma of the fifth nerve, and erosion at the porus acousticus was found in both

Two cases of neurinoma of the tenth nerve were found in this series In 1 patient, who showed widespread involvement of the cranial nerves the authors were able to corroborate erosion of the porus acousticus.

The Pneumoencephalogram of Cerebellar Atrophy J P Murphy and Roman Arana Am J Roentgenol 57 545–555 May 1947

Detailed inspection of the encephalographic appearance of the contents of the posterior fossa is of greatest interest where degenerative disease or maldevelopment of the cerebellum is suspected Air study of the brain, particularly in lateral views with the occipital region of the head superior, can reveal unexpected cerebellar disease, as well as confirm clinical impressions Structural abnormalities of the cerebellum may or may not be associated with cerebellar symptomatology but, if the abnormalities are of sufficient magnitude they may be visualized by pneumoencephalography

Cerebellar atrophies may be subdivided as follows

(A) Progressive degeneration (so-called ' primary"), due to hereditary causes, intoxications, inflammatory processes or unknown causes

(B) Degeneration of the cerebellum secondary to disease of the pontile and olivary nuclei (olivoponto-

cerebellar atrophy), disease of the contralateral cerebral hemisphere ("crossed atrophy"), vascular disease

(C) Progressive cerebellar degeneration complicating Friedreich's ataxia, bulbar paralysis, peroneal muscular atrophy epilepsy, feeblemindedness, etc

Fifteen cases are presented Four of these appear under the heading "primary degeneration or secondary (olivopontocerebellar) atrophy of the cerebellum," 2 are listed as secondary to or associated with cerebral atrophy 2 as secondary to traumatic encephalopathy and 3 associated with Friedreich's disease In the remaining 4 cases hypoplasia (or secondary atrophy?) of the cerebellum was present in cerebral dysgenesis

Cerebellar atrophy may be manifested by an enlargement of the cisterna magna and fourth ventricle, or by a widening and deepening of interfolial sulci and fissures, or a combination of these abnormalities Scalloping and deep fissuring of the surfaces of the hemispheres and nodulation of the vermis are especially evident in cerebellar degeneration of the parenchymatous cortical or olivopontocerebellar types and in Friedreich's disease Increase in size of the cisterna magna and fourth ventricle as compared with the normal is a feature of cerebellar hypoplasia

CLARENCE E WEAVER, M D

Congenital Facial Paralysis J P Murphy and W J German Arch Neurol & Psychiat 57 358–361, March 1947

Facial paralysis occurring in infancy and childhood may be acquired or congenital The former is thought to be due to obstetric trauma, is almost always unilateral and is not accompanied by paralysis of other cranial nerves Congenital facial paralysis on the other hand is usually bilateral, and is almost always associated with paralysis of the abducens nerves Since the first case was reported by von Graefe in 1880 some 60 examples have appeared in the literature These were collected and discussed by Henderson (Brain 62 381, 1939) Many combinations of developmental defects accompanied the facial diplegia and paralysis of the abducens nerve in these cases Pathologic examination was made in 4 instances, in 2 of which there was gross evidence of hypoplasia of the pons and medulla oblongata It has been suggested that malformation of the cerebrospinal fluid system is responsible for the development of the condition

The authors report a case of congenital facial paralysis associated with a multiplicity of developmental defects Encephalographic examination disclosed enlargement of the basal cisterns In addition the horizontal distance from the ventral margin of the pons to the floor of the fourth ventricle was decreased from the normal suggesting hypoplasia of the pons

ANDREW K BUTLER M D
(University of Michigan)

Calcification Occurring in the Eye P B English M J Australia 1 549–551, May 3, 1947

The literature on calcification in the eye is reviewed and a case involving the sclera is presented, presumably the terminal stage of a post-inflammatory fibrosis X ray examination revealed extensive calcification of the posterior portion of the eye extending forward into the lens The eye was enucleated and microscopic study confirmed the roentgen findings The films are reproduced

Evaluation of Diagnostic Methods Used in Cases of Maxillary Sinusitis, with a Comparative Study of Recent Therapeutic Agents Employed Locally Samuel Burtoff Arch Otolaryng 45 516–542, May 1947

One hundred patients were studied in an attempt to evaluate the accepted methods of diagnosing maxillary sinusitis A history of recurrent or persistent head colds was given by the majority of patients Objective methods of diagnosis included anterior rhinoscopy, transillumination, roentgenography, and exploratory irrigation The erythrocyte sedimentation rate, the white blood cell count, and the differential count were recorded for each patient at the beginning and at the end of treatment A vasoconstrictor, ephedrine 1 per cent in saline solution, was given for home use

Anterior rhinoscopy revealed the presence or absence of pus In 72 per cent of the cases studied, when pus was found in the middle meatus, along the middle third or posterior third of the inferior turbinate, it was also present in the antrum

Transillumination did not prove an accurate diagnostic procedure In 29 per cent of the cases, the antra appeared cloudy to hazy, while the antral return was clear following irrigation In another 29 per cent the antra were clear to transillumination, while the antral return was filled with purulent secretion

The roentgen diagnosis of maxillary sinusitis was confirmed in 86 per cent of the cases studied At the first visit a flat plate and one with a contrast medium—two-thirds poppyseed oil (40 per cent) and one-third cottonseed oil—were taken and at the end of treatment a third plate with a contrast medium On the flat plate it is difficult to distinguish between a pathologic condition of the sinus due to excessive swelling of the mucosa one due to a neoplasm, and one due to the accumulation of fluid, with a contrast medium, these distinctions can be made Before taking a film with a contrast medium, saline irrigation was done to determine the presence of pus

The erythrocyte sedimentation rate was high for all patients at the beginning of treatment, with a range of 18 to 50 mm per hour It decreased to normal as the condition improved There was correlation between the sedimentation rate and the state of the antral return, and between the decrease in the sedimentation rate and improvement in the filling defect as seen roentgenographically

Bacteriologic studies of the antral return were made to determine the most effective therapeutic agent A non-bactericidal and non bacteriostatic agent such as isotonic solution of sodium chloride used locally, proved just as effective in bringing about the resolution of the sinusitis as did sulfathiazole and penicillin solutions also used locally Surgical intervention was recommended where there was no resolution with any of the solutions after as many as twenty-four to thirty antral lavages

Twenty four cases are presented in some detail

X-Ray Diagnosis of Cholesteatoma in the Temporal Bone Sölve Welin Brit J Radiol 20 192–201, May 1947

In chronic otitis it is advisable to distinguish between cases with central perforations of the tympanum and those with marginal perforations as cholesteatomas rarely occur in the former but must be kept in mind in the latter The clinical symptoms are not reliable in diagnosis, as they are variable

Cholesteatoma cannot be diagnosed by x-ray until bone destruction has set in When this has occurred, the first step is to take a combination of views of the temporal bone in various positions so that a complete anatomical picture may be obtained Five projections are advocated

(1) The patient supine the chin drawn in, the central ray directed 35 degrees toward the feet (Towne's projection) This gives a symmetrical view of both sides, revealing slight differences in pneumatization the degree of calcification of the cell walls, and the thickness of the cortical bone

(2) The head in the lateral position, the central ray directed 15 degrees toward the feet This view shows particularly clearly the cells around the antrum, in the tip, over the sinus, in the squamous portion, and at the sino dural angle

(3) The head lateral, the central ray directed 35 degrees toward the feet This view shows the cells in the zygomatic root as well as those of the attic, aditus, and squama Views (2) and (3) are taken stereoscopically

(4) The head lateral, the central ray directed 5 to 10 degrees cranially and 30 degrees toward the face This position demonstrates the condition of the cells in the petrous portion and reveals the diameter of the internal meatus

(5) The standard submental-vertical view This must be taken with the chin far enough extended so that the tympanic cavity and the external auditory canal are free of the mandibles This view shows the presence or absence of exostoses in the external auditory canal and the condition of the ossicles

The recognition of cholesteatoma is by no means easy, especially in the pneumatized mastoid Only positive findings are significant Typically the presence of cholesteatoma is indicated by an angular, polygonal or spherical area of destruction surrounded by a linear zone of calcified reaction The changes may be found in any portion of the mastoid, depending upon the direction in which the growth has taken place Thus a distinction is to be made between cholesteatoma of the external auditory canal, the attic, aditus, eustachian tube and antrum Lesions in the attic may show enlargement of the aditus first In the earliest cases, destruction of the posterior wall of the external auditory canal with enlargement of the aditus supports the diagnosis of cholesteatoma

[In an earlier paper (Acta Radiologica 25 227, 1944 Abst in Radiology 46 531, 1946) the author described his findings in a series of 109 cases of cholesteatoma in the temporal bone.] SYDNEY J HAWLEY, M D

On the Radiological Examination of the Eustachian Tube in Cases of Chronic Otitis Sölve Welin Acta radiol 28 95–103 Feb 28, 1947

The eustachian tube was filled with a contrast medium in 30 cases of chronic otitis and roentgenograms were taken in two projections (*a*) a fully axial view with submento-vertically directed rays, and (*b*) a semi-axial view with parieto-occipitally directed rays In most instances iodized oil, 10 and 40 per cent iodipin, was used, but a satisfactory density can also be obtained with the water-soluble 35 and 50 per cent solution In 9 cases the author succeeded in demonstrating pathologic changes such as strictures, polyps, or inflammatory changes in the mucous membrane, thus securing anatomical explanations of the clinical findings

THE CHEST

Roentgenological Aspects of Battle Injuries of the Chest. Max Rakofsky and Victor P Satinsky Am J Roentgenol 57 583–600, May 1947

This report is based on approximately 200 cases of thoracic injuries observed at a base hospital The importance of all the various positions used in roentgen study of the chest is discussed and the use of the over-penetrated film in identifying foreign bodies through massive pleural effusion is stressed Roentgenoscopy is also valuable

Postero-anterior and true lateral views are ordinarily sufficient to demonstrate and localize foreign bodies Stereoscopy is particularly useful in localizing foreign bodies in intimate relationship to the thoracic cage

Injury to the bony thorax is usually associated with pulmonary or pleural trauma Pulmonary contusion is demonstrable roentgenologically as one or more areas of opacity of bizarre distribution and irregular outline. It resolves more slowly than blast injury or pneumonia

Subcutaneous emphysema is readily shown, appearing as streak-like" areas of increased radiolucency It may be necessary to differentiate it from anaerobic infection

Pneumothorax is frequently demonstrated Tension pneumothorax due to a one-way valve type opening should be recognized and relieved

Hemothorax appears in 75 per cent of battle casualties involving the chest It is imperative to observe these cases closely, both clinically and by follow up roentgen study The well known signs of fluid, together with a history of trauma, presuppose the presence of blood Generally it is present in association with pneumothorax. Occasionally it is loculated or encapsulated in which case it may be represented by irregularly distributed fluid levels In some instances an anteroposterior roentgenogram in the lateral recumbent position will prove useful in revealing loculations not demonstrable in routine views Accurate localization is important in treatment by repeated thoracenteses. Clotted hemothorax may assume a variety of appearances, with mottling, multiple fluid levels, densely thickened pleurae or signs of traction

Pleural sepsis occurs in approximately one fifth of the cases Infection is most frequently superimposed upon hemothoraces and pleural effusion Lipiodol contrast studies are particularly useful for determining the size, extent, and position of empyema cavities and for evaluation of progress

Bronchopleural fistula is an infrequent complication of chest wounds It generally follows empyema, sinus tracts, or surgery Lipiodol is used to demonstrate the fistula

Blast injury is shown as streak like bilateral symmetrical mottling

Thoraco-abdominal wounds represent 10 per cent of battle injuries to the chest and have a 25 to 40 per cent mortality rate. Herniation of abdominal organs may follow Subphrenic abscesses constitute an additional complication of transdiaphragmatic injuries

Missile 'tracks," demonstrable roentgenologically, are occasionally left in lung tissue These may be solid or air-containing The latter type may be mistaken for cavity or abscess

Many illustrative cases are described and roentgenograms of the various conditions are shown

CLARENCE E WEAVER, M D

Value of Tomography in Lesions of the Main Bronchi and Their Larger Sub-Divisions. Stanley Nowell Proc Roy Soc Med 40 399–404, May 1947

Bronchial lesions must deform the lumen of the bronchus if they are to be demonstrated by radiologic methods These deformities usually take the form of a smooth or irregular nodular narrowing, projection of a single nodule into the lumen, complete bronchial blockage, either V-shaped or rounded, or a blocking of the bronchus at its origin, with only a small nick showing These effects may be caused by a large variety of lesions, both benign and malignant intrinsic and extrinsic, and in the main bronchi and their larger divisions are readily visible on tomography

The inflammatory type of intrinsic lesion is granulomatous, usually either tuberculous or syphilitic (gumma)

Intrinsic bronchial neoplasms usually give the appearance of a projecting nodule or bronchial obstruction If a bronchus is not visualized the examination should be repeated as the fault is usually a technical one If however, a bronchus is not seen and the adjacent bronchi show narrowing or deformity then a definite block with invasion of adjacent radicles may be assumed Neither tomography nor bronchoscopy may definitely distinguish an inflammatory from a neoplastic process, although suggestive evidence may be obtained Thus, a single nodule is probably a neoplasm, benign or malignant, a complete V-block especially at the origin of the bronchus, almost certainly indicates a carcinoma

Extrinsic lesions include the lymphoblastomas and the benign mediastinal tumors Both lymphosarcoma and Hodgkin s disease can invade the bronchi, causing a granulomatous occlusion and atelectasis In such cases, the appearances are those of intrinsic invasion Even the extent of invasion is no guide as bronchial carcinoma may infiltrate widely With malignant mediastinal tumors the invasion is usually more hazy and ill-defined often with gross distortion of channels

The author has found tomography useful in cases with clinical signs and symptoms suggestive of malignant growth but without atelectasis or mass shadows Several cases with only slight hilar enlargement showed irregular narrowing of main bronchi, of proved neoplastic origin, on tomography The value of tomography has also been demonstrated in cases of peripheral tumor shadows clear of the main bronchi The author believes that a non-malignant tumor will displace neighboring bronchi The bronchial segments running through a malignant growth are narrowed or occluded by invasion Those adjacent to it are neither displaced nor narrowed M WENDELL DIETZ, M D

Pulmonary Function Following Pneumothorax An Investigation of the Volume and Ventilation of the Lungs Gösta Birath Am Rev Tuberc 55 349–365, April 1947

In a detailed report the author discusses the results of a study to determine the effect on pulmonary function of so-called preventive pneumothorax in patients with pleurisy with effusion but without parenchymal lesions Determination of pulmonary function after discontinuance of the pneumothorax revealed the following (1) Total and vital capacities were diminished (2) Equilibrium and residual capacities were not generally diminished to the same degree and their share in the total capacity thus was increased (3) Impairment of thoracic and diaphragmatic mobility as a result of pleural adhesions was responsible for these changes Since serious impairment of lung function may result when lung contraction develops during pneumothorax treatment, it is suggested that the procedure should be abandoned if this complication appears likely to develop L W PAUL, M D

Community-Wide Chest X-ray Surveys I. An Introduction to the Problem Francis J Weber Pub Health Rep 62 652–658, May 2, 1947

Incorporated in this paper are the precepts of the chest x ray survey in its wider aspects Four major objectives are pointed out (1) the discovery of every person in the country infected with tuberculosis, (2) isolation and medical care of every patient needing treatment, (3) after care and rehabilitation, (4) protection of the afflicted family against economic distress These widely divergent principles involve every component of community life

Most of the community surveys so far undertaken have been of the short-term type, being completed within four to six weeks, but actually it would suffice to cover the same number of persons in two years or even longer, though any program geared so low that more than five years is required for its completion may be seriously questioned

Two types of approach are considered the campaign approach, which, including preliminary publicity and examinations, is measured in days or at most a few weeks, and the continuous program which offers the advantage of joint planning by all community leaders and professional personnel A combination of the two types is probably most advantageous, recurrent campaigns put on with a continuous campaign background The organization of a community-wide x-ray survey should involve joint planning by (1) the official health departments, state and local, as well as other official agencies, such as welfare departments and vocational rehabilitation offices, (2) voluntary associations, state, local and others, and (3) the medical profession At the request of the state or local group, the U S Public Health Service is prepared to conduct a demonstration survey in suitable areas, furnishing the necessary equipment and personnel, but depending upon the state and local health departments for basic services including clinical and follow-up facilities, and upon the community for the basic organizing necessary to bring the people out for examination There are however certain requirements to be fulfilled The area must be in definite need of solution of a particular problem The local community must be prepared to follow up the demonstration adequately and must demonstrate a willingness to co-operate and continue to support a general health program as well as this particular tuberculosis program

In addition to the amount of time to be spent on actual case finding the following points must be taken into consideration

1 Number of units required for the work A fully automatic unit with qualified personnel can expose and develop 500 x ray films in an average working day but a good daily average is 300 films

2 Probable number of cases to be detected that will require treatment and follow up

3 Necessary facilities present in the community and other facilities that must be obtained—clinics, hospital beds and health depart[illegible] facili

4 Facilities needed for follow-up This will include estimates of medical, nursing, and record keeping requirements and of needed provisions for a continuous educational program with emphasis on the interpretation of the control work and the disease

5 Number of personnel needed to carry out the work in the time prescribed

The community-wide chest x-ray survey has been compared to the modern military campaign with respect to both tactics and objective The analogy seems justified Whatever we war against, we cannot expect victory if we resort to defense alone we must attack The objective, of course, is complete eradication of the disease SYDNEY F THOMAS, M D

Technique of Chest Fluoroscopy L Walk Acta radiol 28 14–16, Feb 28, 1947

The diagnostic results in chest fluoroscopy are determined not only by the clinical experience of the roentgenologist but also by his technic Fluoroscopy has to visualize hidden lesions as well as to disclose typical aspects which cannot be shown by films in the prescribed positions The author's technic involves three phases, with frequent rotation of the patient (1) inspection of the diaphragm and the basal parts of the lungs, (2) inspection of the heart and the mediastinum and of the general configuration of the chest, (3) inspection of the lungs, especially the apices Diagnostically valuable aspects found at fluoroscopy are fixed by spot films Every exploration is completed by a standard roentgenogram of the chest showing those finer structural alterations which cannot be seen fluoroscopically

Immobilization of Both Lungs Produced by the Equalizing Pressure Chamber with Results of Treatment in Pulmonary Tuberculosis Alvan L Barach Ann Int Med 26 687–703, May 1947

The author describes a modification of the "barospirator" devised by Thunberg in 1926 for artificial respiration in cases of respiratory paralysis due to poliomyelitis or morphine poisoning whereby an equal pressure is simultaneously applied to the inner and outer surfaces of the chest wall, as well as to the upper and lower surfaces of the diaphragm With this device a normal exchange of oxygen and carbon dioxide is maintained without the movements or effort of breathing

Roentgenograms of the chest taken during the positive and negative phase of pressure on the same film during residence in the equalizing pressure chamber revealed no movement of the ribs or diaphragm Not only does this type of local lung rest favor the process of healing by reducing changes in the physical state of tuberculous lesions, but absence of lung movement also may have a specific effect in collapsing those cavities in which a check valve mechanism had been previously operating to keep the cavity inflated This latter assumption is supported by the observation that one of the most striking effects of arrested lung movement has been the disappearance of cavity

This type of local lung rest has been employed in 12 cases of advanced and moderately advanced tuberculosis over a period of nine years Clinical recovery was obtained in 6, marked improvement in 1 slight to moderate temporary benefit in 3 and no change in 2 Patients have been treated from eight to eleven hours daily for a course arbitrarily set at three and one-half to four months When marked clinical improvement has been initiated, the patient is allowed freedom from the chamber for a variable period of bed rest or convalescent care Of the 12 patients, 1 has had three courses of treatment, 3 have had two courses, and 8 one course

In 2 cases a clinical recovery followed a single course of treatment A third patient, recently treated, is apparently obtaining an arrest of his disease, as indicated by negative sputum tests and clearing of infiltrative lesions in the lungs Of the 3 patients receiving two courses, 2 became clinically well, the third showed conspicuous and marked improvement with concentrate sputum and gastric tests repeatedly negative in the past four years However, roentgenograms still reveal evidence of a small cavity at the site of an original large cavity

The sequence of events in the case in which three courses were given indicates the specific effect of lung immobilization (1) disappearance of the cavity in the right lung and decrease in size of cavity in left lung after the first course, (2) increase in size of cavity in left lung after six months modified bed rest, (3) collapse of cavity in left lung after second course, (4) re expansion of cavity in left lung after one year's activity, (5) closure of cavity after third course, followed by clinical recovery and ability to work for four years

In re appraising the results in 2 patients in whom no diminution in the size of the cavity took place the factors considered were (1) the possibility that the cavities were adherent to the chest wall over a wide area and (2) that continuous arrest of lung movement was not obtained, due to failure of adequate supervision STEPHEN N TAGER, M D

Pulmonary Tuberculosis Simulating Bronchogenic Carcinoma. A Report of Four Cases Anibal Roberto Valle and M Lawrence White Jr Am Rev Tuberc 55 449–456, May 1947

Four cases are reported of pulmonary tuberculosis simulating bronchogenic carcinoma to the extent that surgical exploration of the lung was done All of the patients had sputum examinations negative for tubercle bacilli and negative tuberculin tests In three, the removed specimens showed frank tuberculosis In the fourth, the lesion was chronic inflammatory in nature and was thought to be *healed tuberculosis* In all of the cases the roentgenograms were suggestive of carcinoma It is pointed out that the symptoms of cough gradually becoming productive small hemoptyses, chest pain weight loss and weakness are all common to bronchogenic carcinoma and tuberculosis or other chronic inflammatory disease If orthodox methods of examination carefully and repeatedly applied fail to differentiate between these diseases exploratory operation is justified L W PAUL, M D

Bronchiectasis Secondary to Primary Tuberculous Infection in Infancy T Valledor Rev cubana pediat 19 264–295, May 1947

For ten years in the Pediatric Dispensary and in the Angel Aballi Anti-Tuberculosis Children's Sanitarium, a considerable number of cases of primary tuberculous infection have been systematically studied with bronchography, repeated in each case at intervals of from three months to a year The objective was the search for secondary bronchial lesions and the obstructive bronchial factors in the pathogenesis of infiltrative and atelectatic forms of primary infection in children Bronchoscopy was also done in a large number of cases

One hundred cases of bronchiectasis secondary to tuberculous primary infection were selected for study Secondary bronchiectasis is very frequent following tuberculous primary infection in children, in fact, it occurs in the majority of cases The degree and importance of bronchial dilatation varies from a small, residual dry bronchiectasis to a large, wet bronchiectasis, which may progress to the point of crippling the patient Most of these dilatations are due to bronchial obstructions caused by compression of enlarged lymph nodes, bronchial spasm, allergic edema of the mucosa, and accumulated secretions The bronchial obstructions are followed by atelectasis, either lobar or segmentary The obstruction may be total or partial, usually it is total only in the first transitory phase of the process After a few days or weeks the bronchus becomes permeable and dilatations of the tributary branches become visible bronchographically Bronchiectasis is of gradual development and gives bronchographic shadows of variable gradation, ranging from the aspect of bamboo cane, pea pod, etc to the typical cylindrical ampullar and saccular dilatations

One often sees very great displacement of the affected bronchial branches due to the atelectatic retraction, and in some cases to the compression of the obstructive emphysema of the neighboring zone The bronchiectasis is usually localized in the right middle lobe sites next in order of frequency being the right upper lobe, the left upper lobe, including the lingula, and the inferior lobes Many of the residual bronchiectases are dry and give few or no symptoms at all especially when located in the upper lobes In the middle lobe the lingula, or in the inferior lobes especially when the atelectasis is chronic, there develops a syndrome of internal asymmetry Anorexia occurs, there is cardiorespiratory insufficiency, morning expectoration is accentuated, finally hemoptysis, sometimes profuse may develop

JAMES T CASE, M D

Pulmonary Type of Tularæmia (Two Cases) A G MacKinnon Canad M A J 56 541–542, May 1947

Two cases of the pulmonary type of tularemia from the Northwest Territories are presented The patients were an Indian woman and her four-year-old son Infested squirrels had been skinned in their one room log cabin

In the first case, the x rays on admission showed bilateral density in the lungs, which was considered to be a pneumonic process, with possibly left-sided pleurisy A subsequent film showed some residual mottling, but a repeat film later showed no definite evidence of pulmonary disease In the second case, the x rays showed increased density in the right chest, but not of a uniform nature This was thought to be due to pockets of empyema, or possibly a pneumonic condition

In these two cases there was no apparent "portal of entry" lesion The lymph nodes were not noticeably enlarged

DANIEL WILNER, M D

Lung Changes Associated with the Manufacture of Alumina Abrasives. Cecil Gordon Shaver and Andrew Rutherford Riddell J Indust Hyg & Toxicol 29 145–157, May 1947

The authors report a series of cases of lung disease developing in connection with the manufacture of an abrasive the main ingredient of which is bauxite The etiology is doubtful The industrial process, which had previously been considered innocuous, involves exposure to high concentrations of alumina and silica, both in a very fine state of division, and to small quantities of many other substances The disease is essentially an interstitial lung fibrosis, non-nodular in type It may be rapidly progressive Profound emphysema accompanies the invading fibrosis Emphysematous blebs and bullae occur on the visceral pleura These are apt to rupture spontaneously and give rise to pneumothoraces

Of 344 individuals exposed in four different industrial plants, 35 showed definite radiological evidences of disease and 13 others lung changes classified as doubtful In general, well established cases show a widening of the mediastinal shadow, which may partially obscure the shadows of the hili As a rule, the diaphragm is irregular It shows tenting and frequently is elevated The distortions of the mediastinum and diaphragm become less marked or may disappear when pneumothorax occurs Indeed, a mediastinal shift away from the side of extensive collapse is the rule There is always bilateral shadowing in the lung fields This is lace like or granular in appearance It is more pronounced in the upper halves of the fields and more intense toward the lung roots It tends to shade off toward the periphery Coarser shadowing throughout the lung fields is frequent in the more advanced cases In these the lace-like quality tends to be lost Emphysematous changes indicated by large clear areas enclosed in ring like shadows, also characterize the advanced cases Very often this type of shadowing is more pronounced at the periphery of the lung fields In one case a very definite bleb like shadow was present on the pleural surface of the collapsed lung

Evidence of fluid in association with pneumothorax was occasionally seen This was not common however, and showed no tendency to persist Fluid was never diagnosed on physical examination It is significant that in no case with pneumothorax did secondary infection in the pleural cavity develop In none was there clear radiological evidence of complicating tuberculosis Neither has follow-up demonstrated that tuberculosis was a factor in any case Roentgenograms are reproduced to illustrate the changes which occurred over a period of three years in one patient

The disease has been fatal in 7 instances In several it has progressed rapidly and has produced serious disability These cases most closely resemble some described in the German literature as a result of exposure to aluminum dust

Disseminated Ossified Nodules in the Lungs Associated with Mitral Stenosis A Elkeles Proc Roy Soc Med 40 405–408 May 1947

The purpose of this paper is to emphasize a special type of pulmonary nodular calcification occasionally associated with mitral stenosis The nodules were found to consist of true bone in cases of this type previously reported and in the two additional cases herein described Evidence is produced indicating the probability that these lesions are the end result of rheumatic pneumonitis and not the outcome of chronic passive congestion as hitherto believed

Calcified miliary tuberculosis presents the greatest difficulty in differential diagnosis Association of the calcifications with mitral stenosis should raise doubt as to their tuberculous character for p[illegible] losis, although a common com

heart disease, is only rarely associated with mitral stenosis The distinguishing features of the chest roentgenograms of the two conditions are as follows In *mitral stenosis*, the calcified nodules vary from the size of a pinhead to that of a pea They show various shades of density, are not always discrete, and have a tendency to coalesce The nodules are distributed over the central as well as the peripheral lung fields In *calcified miliary tuberculosis*, the calcifications are discrete and more uniform in size and density They mainly involve the central lung fields There is usually evidence of a primary or post-primary tuberculous lesion

Calcified miliary nodules occur, also, in a number of other conditions, as pneumoconiosis, pneumomycosis, sarcoidosis, etc but these may usually be differentiated on the basis of the history clinical picture, and laboratory findings Finally the calcifications of mitral stenosis are not to be confused with the miliary type of long-standing passive congestion also associated with that disease, due presumably to a combination of swollen end-on vessels and alveoli filled with heart-failure cells M WENDELL DIETZ, M D

Mediastinal Tumors in Leukosis Jørgen Bichel Acta radiol 28 81–94 Feb 28 1947

In the last fifteen years, 217 patients with leukosis were treated at the Radium Center for Jutland (Denmark) Fifty-three of the cases were chronic myeloid, 129 chronic lymphatic, and 22 acute leukosis, the rest (13) were either more uncommon forms or the diagnosis was uncertain At the time of the report, 39 of the patients were still alive, 9 with chronic myeloid, 30 with chronic lymphatic leukosis

Among the patients with acute leukosis, there were 4 in whom mediastinal tumors were found, probably arising from the thymus In 2 of them, this tumor was the predominant symptom at admission These 4 cases are reported in detail and discussed together with 114 cases from the literature.

The combination of tumor in the anterior portion of the mediastinum with a leukemic blood picture is most frequently seen in children, chiefly in boys In most cases, the tumor seems to have been due to a proliferation of round cells in the thymus, but the histogenetic connection between these and the various thymic elements is not yet fully elucidated In many cases the tumor appeared to be primary in relation to a subsequent generalization Though it is doubtful if the cases of this type can rightly be considered as constituting a pathologic entity, essentially different on the one hand from leukoses and on the other from lymphosarcomas, the author thinks that there are good grounds for considering them clinically as a separate group

It is possible that radiotherapy may in some cases hasten the development of the leukemic phase, but as a palliative measure cautious roentgen treatment is nevertheless of great value as a means of reducing the great severity of the symptoms caused by the presence of the large intrathoracic tumor, which often is extremely radiosensitive

Diagnostic Value of Roentgenography and Fluoroscopy in the Diagnosis of Rheumatic Heart Disease John B Schwedel Am J Med 2 517–524 May 1947

In a seminar on rheumatic fever Schwedel discusses roentgenography and fluoroscopy of the heart in the diagnosis of rheumatic heart disease under the following headings (1) value in arriving at an etiological diagnosis, (2) estimation of the anatomical sites of lesions, (3) manifestations of rheumatic activity, (4) as an aid in estimating the age or duration of cardiac involvement, and (5) clinical correlation between signs and symptoms and their roentgenologic manifestations

(1) There is no typical roentgen picture in rheumatic heart disease In response to various kinds of damage there is cardiac enlargement involving one, two, or even all chambers Enlargement of the left auricle and the right ventricle are frequently associated in mitral valve disease It is the association of enlargement of the individual chambers that is suggestive, however, rather than the over-all shape of the heart

(2) The size of the individual chambers is important and is determined chiefly by fluoroscopy, with confirmatory films in the postero-anterior and in the right and left anterior oblique positions

(3) The appearance and regression of a pericardial effusion in patients with rheumatic heart disease are generally acknowledged as evidence of rheumatic activity In the author's opinion, progressive cardiac enlargement or individual chamber enlargement, over previous findings, also indicates rheumatic activity even in the absence of congestive failure

(4) Valvular or pericardial calcification is a late finding in rheumatic heart disease never having been found by Schwedel before eight or ten years after the onset of the initial episode of rheumatic fever Pulmonary fibrosis of the stippled variety, simulating miliary tuberculosis and at times silicosis, is a late sequel of chronic recurrent pulmonary congestion in patients with rheumatic mitral valvular disease An interesting and an important aid in estimating the age of cardiac involvement is the finding of elevation and compression of the left main bronchus by an enlarged left auricle Compression of the bronchus can occur only while the bronchial cartilage is soft and pliable, that is not beyond the teens Elevation of the left bronchus without compression may occur after that age

(5) The roentgenologic pulmonary manifestations of rheumatic disease may be classified as follows (1) pulmonary congestion vascular and interstitial, (2) pleural effusions, general, loculated, and interlobar, (3) pulmonary infarction, (4) acute pulmonary edema, (5) chronic pulmonary edema, (6) rheumatic pneumonia, (7) pulmonary fibrosis, (8) pleural thickening

Direct Intracardiac Angiocardiography—Its Diagnostic Value Ignacio Chávez, Narno Dorbecker, and Alejandro Celis Am Heart J 33 580–593, May 1947

The authors describe their method of direct intracardiac angiocardiography using 50 to 90 c c of a 70 per cent diodrast solution This is injected through a No 12 or 14 rubber catheter introduced into the heart through an exposed external jugular vein The tip of the catheter is positioned under fluoroscopic control, either in the right auricle or the right ventricle as desired The article is profusely illustrated and the authors describe the right and left heart and aorta as found in normal and abnormal states In the presence of abnormal conditions the contrast substance may follow the normal circuit or may take an anomalous course, because of perforations anomalous vessels, and shunts

The authors claim the following advantages for this method (1) it places the opaque substance where it is desired, (2) it immediately opacifies the part to be visualized, (3) the contrast substance is injected very rapidly, without dilution Among the conditions in which it has been found useful is patent ductus arteriosus While the duct cannot itself be visualized, a delayed back-flow filling of the pulmonary artery at the time that the aorta fills is a decisive radiologic sign

HENRY K TAYLOR, M D

Congenital Aortic and Subaortic Stenosis with Associated Anomalies of the Aorta. A Grishman, M F Steinberg, and M L Sussman M Clin North America 31 543–556, May 1947

The authors' study of 23 cases of aortic and subaortic stenosis led them to the conclusion that this diagnosis should be considered whenever a loud, harsh systolic murmur is encountered in the right second space, over the mid sternum or at Erb's point The presence of a soft diastolic murmur without peripheral signs of insufficiency does not exclude the diagnosis

The need for careful palpation of the arterial pulses is particularly brought out The systolic thrill and murmur were often recognizable in the innominate and carotid arteries The configuration of the pulse tracings recorded over these vessels however was the most important diagnostic sign The characteristic finding as revealed in these tracings was a slow initial rise an anacrotic notch, systolic vibrations, and a systolic plateau Electrocardiograms showed either normal or left axis deviation

Roentgen examination revealed varying degrees of left ventricular enlargement The ascending aorta often is prominent with its convexity to the right increased Marked dynamic pulsations are frequently noticed Angiocardiography did not demonstrate the stenotic zone clearly, with the possible exception of one case in which a definite infravalvular irregularity was seen It is hoped that roentgen exposures made in predetermined phases of the cardiac cycle will assist in this demonstration

Of great interest was the frequent finding of associated abnormalities of the aorta The prominence of the ascending aorta seen by conventional roentgenography proved to be due to post stenotic pulmonary artery dilatation, which occurs in about one half of the cases of pulmonary stenosis However narrowing and angular deformity of the aortic isthmus were also encountered

In the authors' opinion aortic and subaortic stenosis are not so commonly benign as is ordinarily thought

Coarctation of the Aorta Clinical and Surgical Aspects Rodolfo Kreutzer, Angel D Gonzalez Parente, and Alfonso R Albanese Rev argent de cardiol 14 79–102 (May–June), 1947

This is a lengthy discussion of the subject of aortic coarctation based upon 5 cases found among 8,000 children seen in the cardiologic clinic of the Hospital de Niños (Buenos Aires) The authors follow the classification of Bonnet, who in 1903 divided his cases into infantile and adult types, the former so named because the stenotic portion involves the entire isthmus of the aorta and is accompanied by serious cardiac malformations which bring about death shortly after birth In the adult type, on the other hand, the coarctation is the only important anomaly and the stenosis is much less extensive—one centimeter or less It is usually found at or just below the opening of the arteriovenous duct or of the arterial ligamentous structure remaining after its obliteration The clinical importance and symptoms depend upon the degree of obstruction in the discussion of which Abbott's classification is followed Angiocardiography is recommended as permitting a precise diagnosis of the level and grade of the stenosis It is recommended that in every pediatric examination the femoral and abdominal pulse should be routinely palpated and compared with the radial pulse The electrocardiogram is valuable, showing left axis deviation, deep Q in lead 3, deep S in lead 1 and in all the precordial leads

JAMES T CASE, M D

Coarctation of the Aorta, II Clinical Features Crighton Bramwell Brit Heart J 9 100–124, April 1947

Twenty six cases of coarctation of the aorta are reported In 20 patients, the diagnosis was made clinically, in 5, roentgenologically, and in one at necropsy The classification (Evans Quart J Med 2 1 1933), clinical manifestations and prognosis of the condition are discussed The roentgen diagnosis is to be taken up in more detail in a subsequent paper

Traumatic Dissecting Aneurysm of the Aorta Djin-Yüan Guo Acta radiol 28 25–31, Feb 28 1947

A case of dissecting aneurysm of the aortic arch following trauma to the chest is recorded, with radiologic findings over a period of years The symptoms immediately following the injury (in 1935) subsided and the patient was thereafter in excellent health with no cardiovascular complaints even during the strenuous period of military service A routine roentgen examination in 1944 showed the presence of the aneurysm The author regards this history of rapid regression of clinically threatening early symptoms and subsequent freedom from complaints as almost classic and believes that it probably accounts for the fact that the condition has been considered extremely rare

Unusual Longevity in Aneurysm of the Thoracic Aorta. Ralph Kauntze Brit Heart J 9 96–99, April 1947

A case of aneurysm of the thoracic aorta of prolonged duration is recorded The first symptoms referable to the aneurysm occurred in 1919, and in 1921 the lesion was sufficiently advanced to cause dysphagia and hemoptysis The patient was given mercury inunctions potassium iodide and later five injections of novarsenobenzol following which there was no further antisyphilitic treatment until September 1931 The hemoptysis recurred temporarily in 1934 and again in 1941 In 1946 the patient's condition was still reasonably good though there was a sudden increase in the size of the aneurysm X-ray examination showed calcified plaques in the aorta and in parts of the aneurysmal sac

The Radial Kymograph Mario Lenzi Radiol med (Milan) 33 244–251, May 1947

The author points out that the true kymographic record of a moving organ requires that the position of the slit coincide with the direction of the motion Since many of the motions of the heart and great vessels occur

in radial directions, the author has built and used a kymograph with fixed radial slits and a rotating film, with excellent results CESARE GIANTURCO M D

THE DIGESTIVE SYSTEM

Unique Case of Foreign Body in the Esophagus Virgil J Schwartz Arch Otolyarng 45 562–567, May 1947

A case is presented in which a coin (a quarter) accidently swallowed by a seven-year-old boy passed through the esophageal entrance in the usual manner, but somehow made its way toward the extreme left of the esophagus and turned in an anteroposterior position, perhaps through striking the bulge of the arch of the aorta Thus the posterior edge of the coin became wedged in an esophageal pocket beside the body of a vertebra, while the anterior edge was similarly wedged in a pocket to the left of the trachea It is probable that downward escape was prevented by the left main bronchus, which leaves the trachea between the fourth and fifth thoracic vertebrae Thus the coin was caught laterally by the distended esophageal wall and the arch of the aorta, posteromedially by the vertebra, anteromedially by the trachea and antero-inferiorly by the left main bronchus Anteroposterior and lateral roentgenograms are reproduced

Diagnosis and Treatment of Cardiospasm Porter P Vinson South M J 40 387–391, May 1947

Vinson discusses the various aspects of the entity called cardiospasm Although the exact etiology is obscure the condition is probably the result of a disturbance in the nerve-muscle mechanism of the esophagus with degenerative changes occurring in the vagus nerve endings and a resultant overactivity of the sympathetic system There is, however, some disagreement about the nerve ending degeneration theory

Cardiospasm occurs more frequently in men than in women, in a ratio of 3 to 2 The chief symptoms are dysphagia, weight loss regurgitation of material from the esophagus, dyspnea and cough, and epigastric pain Physical examination gives little diagnostic aid Radiologic studies are important, especially in demonstrating lesions from which cardiospasm must be differentiated Among these are esophageal hiatus hernias of the short esophagus type, paraesophageal hernia, carcinoma, and diffuse spasm of the esophagus A dilated esophagus filled with food may cast a shadow suggesting a mediastinal tumor

There are three varieties of therapy for cardiospasm (1) medical, (2) operative, and (3) mechanical dilatation of the cardia In the author's experience stretching the cardia by means of large esophageal sounds or hydrostatic dilators passed over previously swallowed silk threads provides the most effective method of treatment This procedure, he believes will provide relief from symptoms in 75 per cent of patients treated Plastic operations are seldom required and operations on the sympathetic nerve supply have produced no satisfactory results WILLIS MANGES, M D

Roentgen Diagnosis of Phlegmonous Gastritis. K Lindblom Acta radiol 28 33–36, Feb 28, 1947

Phlegmonous gastritis is a suppurative lesion, chiefly involving the submucosa, it is most frequently diffuse, like an erysipelas but is occasionally localized, as a carbuncle Some 400 cases have been recorded, almost all diagnosed at necropsy Roentgen studies have been recorded in 9 cases reported by various authors Only 5 of these were acute or subacute, and only 2 of them diffuse In spite of the inhomogeneity of the material, the characteristic roentgen change seems to be "a smoothed surface of a narrow lumen with or without remnants of thick mucosal folds" This obliteration of the mucosal folds and the narrowing of the lumen correspond closely to the anatomical features of the lesion The enormous edema and the cellular infiltrations are particularly marked in the submucosa which may have a thickness of 1 to 2 cm

In the case reported by the author, the phlegmon followed resection of a chronic gastric ulcer Symptoms of an inflammatory condition in the left hypochondrium occurred Roentgen examination revealed obliteration of mucosal folds, previously normal, and signs of thickening of the gastric wall After chemotherapy the mucosal pattern again returned to normal, and the thickness of the wall decreased No other location of an inflammatory process than in the gastric wall itself would explain roentgen findings of this type, and in instances of a septic condition in the left hypochondrium these findings may be considered pathognomonic of a gastric phlegmon

Diverticula of the Duodenum A G Barsh Texas State J Med 43 21–23, May 1947

The diagnosis of duodenal diverticula is entirely radiological The author found 32 cases in 2,100 consecutive roentgen examinations Of the 32 cases, 22 involved the second or descending portion of the duodenum, 8 the third portion, and 2 the fourth portion In only one instance was the diverticulum on the lateral or convex aspect of the duodenum The etiology is not known, though weakness of the wall at the site of passage of vessels through it is thought to be a predisposing factor and increasing age a contributing factor The author does not believe that diverticula are congenital in the sense that they exist at birth, as they are rare in young people.

The diagnosis depends on the demonstration of a mass of barium in a pouch, which is generally rounded and is attached to the gut by a pedicle of varying size and in communication with the main stream of barium The pouch of the diverticulum may not fill at the first examination and repeated examinations may be required Retained barium in the ampulla of Vater should not be confused with a true diverticulum

Tenderness to pressure directly over the duodenum is an important point in determining otherwise undisclosed causes for symptoms Evidence of inflammatory tissue in the wall of the diverticulum is rare, but the presence of heterotopic pancreatic tissue is frequent These diverticula may give rise to symptoms as the result of ulceration Associated gallbladder disease is relatively frequent The diverticula about the ampulla may disturb bile drainage In a similar way pancreatitis may be produced

Surgical intervention is not required in most cases unless it can be shown quite conclusively that the diverticula are a direct or indirect cause of symptoms Medical treatment is usually similar to that for peptic ulcer, plus postural drainage when bowel content is retained abnormally in the pouches

B S KALAYJIAN M D

Roentgenological Contribution to the Diagnosis of Functional Intestinal Disorders Harry M Weber J A M A 134 226–229 May 17, 1947

The author briefly discusses the physiology of intestinal functions in the first part of the article After pointing out the interdependence of the various functions, he correlates clinical symptomatology with roentgenoscopic findings A discussion follows of intestinal dysfunction associated with organic disease in the intestine itself as compared with dysfunction due to extra intestinal disease Finally the problem of intestinal dysfunction without demonstrable cause or association is attacked The psychologic as well as unphysiologic, aspects of roentgenoscopic examination are pointed out, with their effects on the interpretation of the examination It is proposed that the roentgenologic examination that is undertaken specifically for the study of intestinal function be better adapted to that purpose, chiefly by elimination so far as possible, of all extraneous factors that may influence intestinal function adversely In closing, the point is made that the greatest contribution which the roentgenologic examination of the intestine makes to the diagnosis of functional intestinal disorders is the facility and accuracy with which it can be made to exclude organic intestinal disease as the cause of the clinical manifestations of dysfunction D A Koch, M D
(University of Michigan)

Benign and Malignant Tumors of the Small Intestine Thomas W Botsford and Roy E Seibel New England J Med 236 683–694, May 8 1947

Tumors of the small bowel are admittedly unusual but this in no way excuses one from considering their possibility This study is based on a total of 65 cases of primary tumors of the duodenum jejunum and ileum, of which 33 were malignant

Carcinoma of the small bowel is usually adenocarcinoma All of the authors' carcinomas (18) were of that type In the duodenum the tumor may arise from an ulcer or a polyp The typical adenocarcinoma of the small bowel gives an annular constriction and is not a large tumor

Lymphosarcoma originates in the lymphoid tissue of the bowel wall chiefly in the ileum with early involvement of the mesenteric lymph nodes The lesion is usually diffusely infiltrating and a mass is often palpable

Argentaffinoma is usually benign and radical resection is indicated even in the presence of metastases The tumor has a distinctive yellowish color

Lipomas are usually located in the submucosa and may become pedunculated

Adenomas of the small intestine are pedunculated and may undergo malignant change

Leiomyoma is as a rule a small sessile tumor and rarely undergoes malignant change

There is no characteristic symptomatology of tumors of the small bowel However, obstruction with intussusception is not an unusual finding and bleeding may result in a secondary anemia An important feature is the history of repeated negative x ray examinations of the colon and upper gastro intestinal tract, which should lead one to suspect a small bowel lesion

In x ray study of the small bowel a flat film of the abdomen may reveal an area of obstruction with intussusception Direct examination may be made by serial films of the abdomen, taken at half-hour or hourly intervals, after barium by mouth Another method is to pass a Miller-Abbott tube into the duodenum and, under fluoroscopic observation, note the progress of barium through the small bowel Spot films, of course, are of great advantage Still another method is to pass the Miller Abbott tube as far as the obstructing lesion and then introduce a small amount of barium at this level to define the lesion
John B McAneny, M D

Cholangiography Performed with the Help of Peritoneoscopy H Royer and A V Solari Gastroenterology 8 586–591 May 1947

Using a small (4 mm) peritoneoscope as a guide the authors have successfully injected the gallbladder directly with a special double needle inserted through the abdominal wall The peritoneoscope is inserted just below the liver margin and about 3 to 5 cm lateral to the mid-line The gallbladder is localized, and the double tube type of needle is pushed through the abdominal wall 1 cm from the peritoneoscope Then under direct vision the inner needle is inserted into the gallbladder Specimens of bile may be aspirated if desired Twenty to 40 c c of a radiopaque aqueous medium are injected, the instrument is removed, and roentgenograms are made immediately

It is usually possible to visualize the gallbladder, the cystic duct the hepatic ducts, and the common bile duct Anatomically, the only new finding was a sharpening or beveling of one side of the terminal end of the common duct not seen previously Physiologically, the gallbladder tends to contract uniformly without significant change in shape and no evidence of peristalsis was seen at any time In most cases there was a contraction of the neck near the cystic duct In some cases the dye was seen to go up into the hepatic ducts when the gallbladder contracted, suggesting failure of the sphincter of Oddi to relax The authors could demonstrate no evidence of sphincteric action at the lower end of the main hepatic duct or of peristalsis along the common duct Gallstones within the gallbladder were easily demonstrated, and in some cases stones in the common duct were seen A diverticulum of the cystic duct was demonstrated in one case and in several a narrowing or obstruction at the lower end of the cystic duct was visualized

The technic was not employed in any case in which there was evidence of acute inflammatory change in the region of the liver No accidents or serious sequelae occurred In some cases there was bile leakage through the puncture wound in the gallbladder, but in no instance did peritonitis develop
B S Kalayjian, M D

Report of a Case of Spontaneous Cholecystoduodenostomy Gordon J Culver and John Richard Kline Am J Digest Dis 14 162–163, May 1947

A case of spontaneous cholecystoduodenostomy is presented by the authors who succeeded in filling the gallbladder common duct and left and right hepatic ducts with barium An excellent reproduction of the film showing the filled ducts accompanies this article The history obtained from the patient, a white female aged 68, suggests that the rupture occurred about three years before it was found by gastro-intestinal examination Joseph T Danzer, M D

Roentgen Findings in Acute Pancreatitis John C Glenn, Jr, and George J Baylin Am J Roentgenol 57 604–615 May 1947

A review is given of the anatomy of the pancreas, and the incidence, etiology, signs and symptoms, laboratory findings and pathology of pancreatitis The authors state that their cases have usually shown rather persistent spasm of the duodenal loop associated in some instances with contour changes The jejunum frequently showed marked persistent spasm of some segments along with apparent or real dilatation of others, and associated with this there was a pronounced coarsening of the folds Also seen were constant areas of spasm in the colon at the mid transverse portion and the splenic flexure, both regions being zones of direct contact with the pancreas

If there is appreciable enlargement of the head of the pancreas, the duodenal loop may be widened and the valvulae conniventes flattened and the inverted "3" sign of Frostberg may be present Some of the small intestine in the region may show alternate areas of spasm and dilatation The duodenal bulb may be lifted or distorted The stomach may be pushed up or forward

An extremely important relationship of the pancreas is that with the diaphragm, for many cases of pancreatitis will show evidence of fluid at the left base due to inflammatory changes occurring in the diaphragm or beneath it There may also be obliteration of the left psoas or renal shadows A duodenal diverticulum which is buried within the pancreas, when inflamed, may lead to pancreatic disease It should also be remembered that the tail of the pancreas is in contact with the diaphragm, splenic flexure of the colon, and the spleen, and inflammation in this portion of the pancreas may affect these organs CLARENCE E WEAVER, M D

THE MUSCULOSKELETAL SYSTEM

Polyostotic Fibrous Dysplasia A Defense of the Entity Fuller Albright J Clin Endocrinol 7 307–324, May 1947

This paper concerns the syndrome (Albright's) which in its complete form is characterized by (1) a disseminated osteitis fibrosa (both hyper- and hypo ostotic) with a segmental distribution, (2) areas of cutaneous pigmentation which have a distribution suggesting some connection with the bone lesions and (3), in the female, sexual and somatic precocity

The author believes the syndrome is not a form of lipoid granulomatosis (xanthomatosis) because (*a*) the blood cholesterol level is not abnormal, (*b*) bone biopsies show 'foam cells" only infrequently, (*c*) the bone lesions show only a slight tendency to progress, clear up spontaneously, and are not radiosensitive, (*d*) the segmental distribution of the bone and skin lesions is not suggestive of a metabolic disorder, (*e*) the x-rays show increased bone formation as well as bone destruction, (*f*) the areas of cutaneous pigmentation are not characteristic of lipoid granulomatosis, (*g*) when the disease is widespread the serum phosphate level is high, (*h*) sexual precocity in females is not a feature of lipoid granulomatosis

The author also believes that this syndrome is not a form of neurofibromatosis (von Recklinghausen) because (*a*) no case has been seen or found in the literature where multiple cutaneous fibromata, a common and pathognomonic feature of neurofibromatosis, and widespread bone disease with evidence of increased as well as decreased bone formation, a common and pathognomonic feature of the syndrome, were present in the same individual, (*b*) the syndrome does not tend to run in families, (*c*) sexual precocity in females is not characteristic of neurofibromatosis, although sexual precocity, especially in males, occasionally occurs because of a neurofibroma in the region of the hypothalamus (pineal syndrome), (*d*) an autopsy on a patient with the syndrome revealed as a possible cause of the precocity not a tumor but a lesion in one mammillary body, (*e*) the bone lesions in neurofibromatosis are not extensive, do not show new bone formation, and are confined to certain localities, notably the upper ends of the tibias and the lower ends of the femurs, (*f*) the areas of cutaneous pigmentation in neurofibromatosis usually have smooth edges rather than the irregular edges which characterize the areas in the syndrome under discussion, (*g*) elephantiasis, so common in neurofibromatosis, has not been found in this syndrome

The terminology is discussed, with the conclusion that the condition had best be termed "polyostotic fibrous dysplasia" as suggested by Lichtenstein (Arch Surg 36 874, 1938)

Osteomalacia and Late Rickets The Various Etiologies Met in the United States with Emphasis on That Resulting from a Specific Form of Renal Acidosis, the Therapeutic Indications for Each Etiological Sub-Group, and the Relationship Between Osteomalac a and Milkman's Syndrome Fuller Albright, Charles H Burnett, William Parson, Edward C Reifenstein, Jr, and Albert Roos Medicine 25 399–479, December 1946

This is an exceedingly comprehensive article covering in detail the points mentioned in the title It is quite impossible to prepare an adequate abstract of it The authors recognize four degrees of osteomalacia with respect to their severity (1) chemical osteomalacia with normal phosphatase, (2) chemical osteomalacia with high phosphatase, (3) Milkman's syndrome, and (4) advanced osteomalacia They regard Milkman's syndrome, characterized by multiple spontaneous idiopathic symmetrical fractures, as a form of osteomalacia for the following reasons (*a*) there is evidence that the lesions described by Milkman are united but uncalcified fractures, and such fractures are a characteristic of osteomalacia (*Umbauzonen* of Looser) and of no other condition, (*b*) the serum calcium, phosphorus, and phosphatase findings in classical and undoubted cases of Milkman's syndrome are those of osteomalacia, (*c*) Milkman's syndrome responds to anti osteomalacic therapy, (*d*) the histopathology in Milkman's syndrome is that of osteomalacia

Osseous Congenital Syphilis Effects of Penicillin on Rate of Healing Allan J Hill, Jr, Ralph V Platou, and John T Kometani J Pediat 30 547–563, May 1947

The authors, following McLean's classification, have divided the findings in congenital syphilis of bone into three categories osteochondritis, osteomyelitis, and periostitis Each category has been divided into several types and a degree of severity has been arbitrarily assigned to each type Acknowledging that their control series is imperfect, the authors have indicated the nature of the changes seen in untreated congenital

syphilis from birth to the age of twenty four months In general, untreated congenital syphilis tends to grow worse up to the age of three months and then subsides in severity Late complete healing may result when early lesions are severe Osteochondritis and osteomyelitis increase in severity up to the age of ninety days and then decrease in severity Periostitis, however, rises more slowly to its peak at six months and then subsides

Healing was found to be more rapid in infants treated by penicillin during the first three months of life In those treated later, healing was slow Analysis of the data showed no significant differences in rates of healing for treated and untreated groups unless therapy was given before the age of three months

It is of interest that there was an increase in severity of bone lesions in some children treated within the age of three months There is also a lag in improvement after therapy given at this age Pseudoparalysis disappears without any specific changes in the roentgenograms In some cases, osseous lesions may appear worse after the pseudoparalysis subsides PAUL W ROMAN, M D

Disseminated Granuloma Inguinale of Bones William J Rhinehart and John T Bauer Am J Roentgenol 57 562–567, May 1947

A review of the literature dealing with bone involvement by granuloma inguinale is given, and a case is reported A Negro woman, aged thirty-three had an ulcerating lesion of the cervix and a mass in the left posterior pelvis which pressed upon the rectum sigmoid colon, and bladder Biopsy of the vaginal lesion confirmed the diagnosis of granuloma inguinale. Roentgenographic examination disclosed the presence of osseous lesions in both tibiae, both fibulae both ulnae, the left radius the proximal phalanx of the right ring finger, both frontal bones and the left astragalus The defects in the bones were multiple irregular, osteolytic lesions of the cortex with no evidence of sequestrum or surrounding osteoplasia The margins of the lesions were not clear cut There was no periosteal proliferation or periostitis Aspiration of the tibial lesion revealed characteristic cells of granuloma inguinale containing Donovan bodies The patient died of hemorrhage from erosion of the left hypogastric vein

There is nothing specific in the roentgenological findings leading to a diagnosis of granuloma inguinale The lesions are essentially osteolytic with no reaction in the overlying periosteum, and no regeneration of bone The final diagnosis rests upon biopsy and the finding of the pathognomonic Donovan bodies and typical phagocytic cells in the microscopic preparations, and a knowledge of the location of the primary lesion

CLARENCE E WEAVER, M D

Dislocation of the Acromioclavicular Articulation A Note on Technique of Radiographic Examination of the Shoulder in Suspected Dislocation at the Acromioclavicular or Humeroscapular Articulation Charles J Sutro Surgery 21 751–754 May 1947

Radiographic examination of the shoulder in patients suspected of having acromioclavicular separation or humeroscapular separation is routinely made in the dorsal recumbent position Thus the weight of the arm is removed from the shoulder and separation of these articulations may not be recognized The author describes a method of examination in the upright position Anteroposterior radiographs are made at intervals during a three minute period while a 5- to 10 pound weight is held in the hand of the affected extremity This gravity traction demonstrates subluxations of the head of the humerus, and luxations of the acromioclavicular articulation

A modification of the airplane splint having a crossed web over the acromial end of the clavicle, is used in maintaining reduction of acromioclavicular separations Excellent illustrations and diagrams are included

[Radiographs of clinically normal shoulders under similar traction are not included, and the possibility that some subluxation of the head of the humerus may occur with traction in normal individuals is not considered — J E W] J E WHITELEATHER, M D

Monteggia Fracture G J Curry Am J Surg 73 613–617 May 1947

A Monteggia fracture is a fracture of the upper end of the ulna with radial head dislocation It may be produced by indirect or direct violence, the basic reason being that the radius and ulna form mutual splints each bound to the other at the top and bottom by strong ligaments and attached almost throughout by the strong interosseous membrane The ulna fractures and shortens, thereby putting stress and strain on the radial head, which becomes dislocated A dislocated radial head should, therefore be suspected when there is a fracture of the ulnar shaft 4 or 5 inches from the elbow Neglect of this condition may result in a severe disability Two types of displacement are described (1) the flexion type occurring in 10 to 15 per cent of the cases in which the radial head is dislocated backwards with the ulnar fracture angulation in the same direction, (2) the extension type, presenting anterior angulation of the ulnar fracture and a radial head displacement upwards and outwards

A case is presented in which the radial head dislocation was severe and the destroyed orbicular ligament was replaced by a segment of the pronator fascia of selected length and width This followed internal fixation of the ulnar fragments A satisfactory result was obtained Roentgenograms are reproduced

Pneumoradiography of the Knee Joint. O Häuptli Schweiz med Wchnschr 77 549–551 May 24, 1947

The author employs carbon dioxide as a contrast medium in roentgen study of the knee joint and recommends an injection pressure of 100–150 mm of water In most instances the use of an iodine preparation for double contrast is contraindicated because of the frequent complications Perfect asepsis is essential The anteroposterior film is made in semiflexion with the central ray parallel to the tibial joint surface the other view is taken in latero medial projection Close supervision by the roentgenologist and co-operation with the surgical staff are essential to obtain sharp pictures The escape of gas into the periarticular structures indicates the presence of a tear which may have been produced by earlier trauma or may be due to the injection as a result of an abnormally weak capsule or excessive injection pressure In the author's hospital at Aarau, the examination is often done on an outpatient basis the only restriction being prohibition of active sports and marching for the following two days No case of infection resulted from this procedure in 1 622 patients studied from 1935 to 1947

The reliability of the interpretations has been determined by operative check Meniscus tears with dislocation of the fragment can be readily identified Tears without displacement of the fragment cannot be seen Asymptomatic lesions demonstrated by x-ray have been repeatedly verified at operation Negative findings are often important in determining the prognosis Cases with obscure clinical findings are especially worth study by this method, as the diagnosis can be clarified in 90 per cent of these

The normal meniscus fuses into the joint capsule with a smooth, regular curve There is great variation in the size of the meniscus If the entire meniscus is slightly separated from the tibia and shifted toward the capsule, it is termed "*lavité*" (relaxation) after the French school, greater separation, especially with narrowing of the joint cartilage, is characteristic of a traumatic lesion The edges are then sharply demarcated Many forms of the meniscus are seen, meniscus bipartitus, menisci of varied height and length, etc In the presence of tears, the meniscus may take on bizarre forms The formation of a step, most commonly on the tibial spine, is especially characteristic Oblique views are often very informative

The shadow of the lateral meniscus is ribbon-like, and generally overlies the lateral femoral condyle It appears raised from its inferior attachment, a normal finding Changes in the lateral meniscus are hard to demonstrate, they are best shown in a lateral oblique view In general, the diagnosis of disease of this structure is more difficult and less reliable than corresponding diagnoses for the medial meniscus Even more difficult is the study of the cruciate ligaments, they may only occasionally be seen near the cortex of the intercondylar fossa Osteochondritis is often easily diagnosed, as the cartilage defect is directly visualized Loose bodies show well, and Hoffa's fat pad is clearly demonstrable LEWIS G JACOBS, M D

Complications of Myelography by Abrodil K Lindblom Acta radiol 28 69–73, Feb 28, 1947

In 721 patients on whom myelography with abrodil was carried out, complications (headache stiff neck, shock, lumbar pains, hyperesthesia) were reported more than 54 times The myelographies were performed by two different technics that described by Arnell (Acta radiol 25 408 1944 Abst in Radiology 46 303, 1946) and Lindblom's modified form (Acta radiol 27 1, 1946 Abst in Radiology 48 101, 1947)

For avoiding complications in abrodil myelography the following suggestions are made A fine needle should be used for the puncture (0 5 mm with an introducer for the puncture of the skin and the ligaments) The patient should be prepared against drop in blood pressure, ephedrine should be given when the pressure drops The head should be raised only during the examination The anesthetic solution should not be too heavy, 1–2 c c of a 5 per cent solution of novocaine is recommended Only approved radiopaque solutions, as 20 per cent abrodil, should be used

Early Localization with the Use of Pantopaque of an Acute Epidural Spinal Abscess Abraham Kaplan and Arthur Lautkin New York State J Med 47 1021–1023, May 1, 1947

Acute epidural spinal abscess is a surgical emergency which can be recognized before the onset of neurologic signs A history of antecedent local infection, such as a furuncle, paronychia, acute sore throat, or osteomyelitis, followed several days or weeks later by an acute onset of fever, chills, and excruciating localized back pain, is very suggestive of this diagnosis There is usually evidence of acute illness, some stiffness of the neck, and extreme localized spinal tenderness Spinal fluid studies will show complete subarachnoid block, xanthochromatic fluid, and increased total protein Myelography with 5 c c of pantopaque should follow immediately The level at which the medium is arrested will accurately establish the site of the lesion Immediate laminectomy, with removal and/or drainage of the infected material will save lives immediately and also prevent the tragic complications of paralysis of the bladder and rectal dysfunction, decubitus, ascending urinary infection, and a drawn out death from renal failure

The authors report what they believe to be the first case of epidural abscess in which the diagnosis was confirmed by myelograms with pantopaque and laminectomy was immediately done with excellent results

B S KALAYJIAN, M D

Congenital Dermal (Pilonidal) Sinus with Dural Connection. Case Report and Discussion. Eugene E Clifton and John R Rydell J Neurosurg 4 276–282, May 1947

A case of congenital sacral dermal sinus in communication with the dural sac and in direct continuity with the filum terminale is presented X rays of the spine revealed spina bifida occulta of the entire sacrum The findings on myelography are of particular interest Fluoroscopy and films showed the pantopaque, as it flowed caudally, to split into two columns The linear defect formed in the pantopaque column began to the right of the mid-line near the lower edge of the 5th lumbar vertebra and extended downward and medially to the mid-line over the 1st sacral segment The findings are considered evidence that dermal sinuses in this area originate as malformations in development of the neural canal

GYNECOLOGY AND OBSTETRICS

Radiography of the Lymphatic System of the Uterus Charles Várady Schweiz med Wchnschr 77 509–510, May 3, 1947

Although reflux of contrast medium into the uterine veins is a not too rare complication of hysterosalpingography, reflux into the lymphatic system has not been previously observed Such an accident is reported in a 40 year old woman, who was being studied for sterility After injection of Iodipin both tubes were found to be obstructed Oil was also scattered through the uterine wall in a streaky fashion, filling the lymphatics It reached the iliac nodes, so as to render them opaque, in about fifty minutes The patient suffered no ill effect from the accident The author proposes the term 'uterolymphatic influx" for this condition, and feels that so rare and harmless an accident does not contraindicate so useful a procedure as hysterosalpingography LEWIS G JACOBS M D

Standardised Radiological Pelvimetry IV Interpretation of Pelvimetry E Peter Allen Brit J Radiol 20 205–218, May 1947

While it is true that roentgen pelvimetry supplies in-

formation only about the bony factors in delivery and that these constitute but one phase of the problem, the author believes that on the basis of pelvic measurements alone a reasonably accurate prognosis of the probable course of labor can be offered in the majority of cases

After a careful correlation of a large number of cases, he has worked out a relatively simple prediction table, assuming the fetal head to have a diameter of 100 mm For larger heads corrections must be made

Vaginal delivery is certain without evidence of disproportion when the conjugate is over 130 mm , the brim area is over 130 sq cm , the mid-plane area is over 120 sq cm , the bispinous diameter is over 110 mm and the posterior sagittal of the outlet is over 65 mm

Vaginal delivery is reasonably certain, but forceps may be required, when the conjugate is between 105 and 130 mm , the brim area is between 105 and 130 sq cm , the mid-plane area is between 95 and 120 sq cm , the bispinous is between 90 and 110 mm , and the posterior sagittal of the outlet is between 50 and 65 mm

Vaginal delivery is uncertain and if possible will show clear evidence of disproportion when the conjugate is between 90 and 105 mm , the brim area is between 85 and 105 sq cm , the mid-plane area is between 80 and 95 sq cm , the bispinous is between 80 and 90 mm and the posterior-sagittal of the outlet is between 45 and 50 mm

Vaginal delivery is unlikely and section is justified in measurements below the lower limits given above

[Abstracts of the earlier papers in this series appear in Radiology 50 137 and 272 January and February 1948] SYDNEY J HAWLEY M D

THE GENITO-URINARY SYSTEM

Genitourinary Conditions in Infants and Children. Herman L Kretschmer J Pediat 30 603–636 May 1947

In this long treatise all of the usual lesions of the genito-urinary tract are described The interesting feature lies in the fact that the cases were diagnosed before the patients reached the adult stage of life The author briefly describes and considers each of the well known congenital anomalies Some of these are illustrated by case reports

A comprehensive description of obstructive lesions of the vesical neck places these lesions in two categories (1) those causing mechanical obstruction, (2) those on a neurologic basis

Two types of renal tuberculosis have been observed (1) renal involvement as a part of general miliary tuberculosis and (2) surgical renal tuberculosis The author believes that with the increased use of diagnostic urologic methods in children more cases of chronic renal tuberculosis are being recognized He does not believe that renal tuberculosis in children is rare but that it has often been overlooked The article contains no photographs or roentgenograms of these cases

The problem of urinary calculi in children is reviewed The findings are the same as in adults Hydronephrosis and hydroureter are due to the usual cause obstruction either from within or from outside the tract

The most common malignant tumor of the genitourinary tract in children is the Wilms tumor Preoperative deep roentgen therapy followed by nephrectomy when the tumor no longer diminishes in size and then by a further course of irradiation has brought about a great reduction in the operative mortality

"The common bladder tumor of infancy and children is the sarcoma " STANLEY H MACHT, M D

Complete Urologic Examination in Infants and Children with Urinary Infection Indications and Importance Meredith F Campbell M Clin North America 31 659–667, May 1947

Attention is directed to the high incidence and potential gravity of urinary infections in the young At the present time more urologic examinations are done in infants and children for pyuria than for any other reason Careful urinalysis of properly collected specimens should be carried out before subjecting any patient to instrumental investigation because of urinary infection, the invading bacteria should be precisely identified and an attempt made to sterilize the urine by medical treatment

Excretory or intravenous urography may be expected to give a satisfactory roentgen delineation of the upper urinary tract in at least 50 per cent of children in whom it is employed Such a study will often direct special attention to one kidney and/or ureter at the time of cystoscopy and retrograde pyelography In general the younger the patient the less likely is the excretory study to be of diagnostic value

Since modern chemotherapy may be successful in eradicating a chronic urinary infection even in the presence of obstruction, calculi and other major urologic lesions an excretory urographic study, at least, should be made before the patient is discharged as cured to determine that the upper urinary tract is morphologically normal Excretory urograms may however be misinterpreted and surgical attack on the upper urinary tract and particularly nephrectomy should not be carried out on that basis alone except in those rare instances in which ureteral catheterization cannot be performed as in tuberculous obliterative ureteritis ureteral hypoplasia or because of insurmountable technical difficulty

Agenesis of the Right Kidney with a Retroperitoneal Cyst Arising in a Persistent Metanephros M F Weingarten, John M Orem, and O C Cox J Urol 57 829–833, May 1947

According to the authors, this is only the third case to appear in the literature of agenesis of a kidney with the concomitant finding of a retroperitoneal cyst The first was reported by Krauss and Straus (J Urol 34 97, 1935), and the second by Kornblum and Ritter (Radiology 32 416, 1939)

The authors' patient was an adult male who was operated upon for appendiceal abscess No abscess was found but a long, clubbed, red appendix was removed At the same time there was discovered just above the bladder a large extraperitoneal cystic mass To avoid peritoneal soiling removal of this mass was postponed to a later date In the meantime cystoscopy retrograde pyelography, and intravenous pyelography showed absence of the right renal shadow and no right ureteral opening in the bladder displacement of the bladder downward and to the left by a pelvic mass and hypertrophy of the left kidney

The cystic mass was subsequently removed by extraperitoneal approach Its fluid content was approximately 500 c c Tissue study showed a columnar epithelial lining with inner circular and outer longitudinal muscle fibers Fibrous tissue was abundant and

replaced muscle tissue in certain areas The picture was that of a congenital metanephric cyst, without evidence of malignancy

The authors believe that the findings in their case are to be explained by non union of the metanephric mass and ureteric bud to form the right kidney As a result the metanephric mass remained in its fetal position and proceeded to normal development with the formation of a cyst as the result of accumulating secretion Absence of the kidney on the right led to a compensatory hypertropy on the left JOSEPH P TOMSULA, M D

Significance of Retrograde Pyelography in the Diagnosis of Paranephritic Abscess Hubert Mäder Schweiz med Wchnschr **77** 560–564, May 24, 1947

The clinical and laboratory findings in paranephritic abscess are often such as to leave the diagnosis doubtful Plain films of the abdomen, if there is good clearing of the gas shadows, may show a diffuse haziness of one kidney region, irregular broadening of one kidney shadow with poor definition, disappearance of one psoas shadow, elevation or immobility of the diaphragm on the affected side, a secondary pleurisy, or scoliosis toward the affected side, but since these signs occur in other surgical conditions they do not of themselves lead to a diagnosis Urographic study gives additional information With the intravenous method, the kidney shadow on the diseased side is denser and larger, the ureter is shown clearly throughout its length, and the kidney is displaced by the mass of the abscess Retrograde pyelography shows displacement of the kidney, rotation and imbalance of the entire pelvic system on all axes, compression of the pelvis, filling defects, and deformity of the calices All of these findings arise from external pressure Study of the respiratory excursion of the kidney is of no conclusive significance Tumors may give rise to a similar picture, but the general clinical findings will distinguish these A lateral pyelogram is of great value, in 90 per cent of cases there is forward displacement of the kidney, so that it lies in front of the vertebral bodies

LEWIS G JACOBS, M D

Translumbar Aortography, an Aid in the Management of the Hydronephrotic Kidney A Keller Doss South M J 40 376–381, May 1947

A discussion is presented of translumbar aortography in the study of renal surgical problems Anatomically the value of the information obtained by outlining the renal arterial tree is obvious, particularly in the diagnosis of embryologic abnormalities From the point of view of physiology and pathology, the usefulness of the procedure, though less striking, is becoming more apparent as clinical and pathological studies demonstrate the association of certain abnormalities of the renal arterial pattern with various syndromes and specific entities

The author has devoted himself chiefly to the use of aortography as an aid in the management of hydronephrosis It is his practice to obtain an arteriogram before undertaking renal exploration, and the knowledge thus obtained has often proved the deciding factor in answering the question Should an effort to save the kidney be made or should it be removed? Accepting the policy that a kidney is no better than its arterial supply, he makes every effort to preserve hydronephrotic kidneys in which this is adequate, reserving nephrectomy for those in which the circulation is poor It is his belief that surgeons should be more conservative in the treatment of hydronephrotic kidneys, especially in the young

Eight cases are briefly presented, with reproductions of arteriograms and retrograde pyelograms In a number of instances the two were obtained in combination The renal arterial circulation is clearly demonstrated

WILLIS MANGES, M D

Roentgenological Localization of Ureteral Obstruction by Non Radio-Opaque or Indistinguishable Calculi G Gill and W Light Canad M A J **56** 513–519, May 1947

The authors describe a method of localizing exactly the offending agent causing ureteral obstruction, be it opaque or non-opaque Intravenous urography is used to demonstrate the site of obstruction Following the administration of 20 c c of dye, films are taken at five minute intervals for the first fifteen minutes (abdominal compression must not be used, since the method is essentially functional) These afford the authors' first roentgen sign, namely *early radiologic evidence of ureteral block* The first few films show a clear-cut outline of the collecting system on one side and lack of visualization of the collecting system on the other side, *i e*, one kidney excretes the dye promptly and the other not at all

On subsequent films, obtained at intervals of fifteen minutes, the shadow of the kidney on the involved side, which was not at first clearly distinguishable, becomes visible, appearing denser and denser with time, until it stands out more prominently than the normal kidney on the opposite side This *impregnation of the renal parenchyma* constitutes the second radiological sign

Now that the parenchyma is densely impregnated with dye, the minor and major calices begin to show up, and in subsequent films made at intervals of fifteen or thirty minutes, the renal pelvis is seen filled with dye, and the ureter is demonstrable The dye comes slowly down the ureter until it is sharply halted, indicating beyond question the site of obstruction This third sign is called by the authors *the stasis*

By the time the obstruction is localized, it is noted that the dye outlining the collecting system on the normal side has come and gone The radiograph now obtained is a mirror image of the visualization of the collecting system at the beginning of the examination This confirmatory sign has been called a *reverse visualization of the collecting system*

In 51 cases in which this procedure was used, it led to the localization not only of 25 easily distinguishable stones, but also of 20 which were otherwise indistinguishable from a maze of calcifications and phleboliths, and of 6 that were definitely not radiopaque Five case histories are included, and films are reproduced

DANIEL WILNER, M D

Pseudo-Sphincter Formation in Neurogenic Bladder Charles Ney, Oscar Auerbach, and Thomas I Hoen J Urol **57** 858–868, May 1947

In the course of their studies on the neurogenic bladder, the authors encountered a sphincter like structure, designated as a pseudo-sphincter, in 8 of 21 paraplegics It was situated in the prostatic urethra, just distal to the colliculus seminalis (verumontanum) in the region of the inferior crista It was pale to pinkish red, with a

sharp or more or less rounded corrugated edge Microscopically it was lined by transitional cell epithelium and composed of connective tissue with some hyalinization. An extensive acute or chronic inflammatory process with edema was present Submucosal glands and a small amount of muscle were found

Three cases are reported in detail Cystourethrograms were obtained in one case, revealing division of the prostatic urethra into a proximal dilated portion and a distal portion which tapered into the membranous urethra with some narrowing in the region of the internal sphincter

The significance of the pseudo sphincter is not explained The authors express the belief that it represents the boundary between the prostatic urethra, which arises embryologically from terminal portions of primary excretory ducts, and the distal prostatic urethra, which arises from the urogenital sinus

PAUL R NOBLE, M D

SINUS TRACTS AND FISTULAS

Roentgenographic Demonstration of Sinuses and Fistulae. Robert C Pendergrass and William C Ward Am. J Roentgenol 57 571–577, May 1947

The use of iodized oil was found to be helpful in the investigation of complicated war wounds in an army general hospital that was treating a fairly large number of spinal cord and cauda equina injuries With aseptic technic a small rubber catheter or rubber tipped syringe was inserted into the external opening and the iodized oil was injected under roentgenoscopic observation "Spot" films were often used Stereoscopic and lateral views were also considered essential Barium and air studies of the colon were sometimes used in combination with the sinus tract injection in instances of fecal fistula Iodized oil was not injected in any case in which a spinal fluid fistula was suspected

Six cases are presented in which essential information was obtained by lipiodol injection in these difficult sinus tract cases In one case of fecal fistula through the sacrum and the fifth lumbar interspace, communication with the sigmoid colon was shown by lipiodol injection A transverse colostomy was done and complete healing of the fistula followed In another case a urinary fistula through a wound in the region of the fifth lumbar vertebra was found to communicate with the lower end of the left ureter A left nephrectomy was performed In a third case there was a communication through an abscess in the right upper abdomen into a small bile duct Better drainage was established and the fistula healed

CLARENCE E WEAVER, M D

RADIOTHERAPY

Treatment of Malignant Melanoma. Report of 862 Cases. George T Pack S L Perzik, and Isabel M Scharnagel. California Med 66 283–287, May 1947

An analysis of 862 cases of malignant melanoma of which 595 were available for five-year end-result study, with an over all salvage of 9 7 per cent, is presented Before 1935, irradiation was the primary mode of treatment x rays, telecurie therapy by a large radium bomb or pack, superficial radon plaques, and the interstitial deposition of gold radon seeds Since 1935, surgery has been the primary therapeutic agent In these two groups of unselected cases of localized melanoma, surgical treatment secured five times the salvage for three years and twenty three times the salvage for five years that was obtained by primary irradiation Whenever metastases to regional lymph nodes had occurred, the salvage at three years was nearly three times greater and at five years two and one-half times greater as a result of predominantly surgical treatment

A comparison of all patients with localized melanomas treated by irradiation and by surgery, regardless of the time period shows that surgery yielded 38 4 per cent salvage at three years, as against 1 6 per cent for irradiation, and 17 7 per cent as against none for five years The same proportionate increase in salvage is revealed in the treatment of patients with metastases to the regional lymph nodes Included in the analysis are 18 patients surviving from ten to seventeen years all of whom had undergone surgical treatment, with or without irradiation No patient was treated solely by irradiation All these patients had dissection of the regional nodes, and in 7 the nodes showed metastases

Malignant Lymphoma Value of Radical Surgery in Selected Cases C Alexander Hellwig Surg , Gynec & Obst 84 950–958, May 1947

From January 1925 to December 1945 234 cases of malignant lymphoma were studied in the Pathological Department of St Francis Hospital Wichita, Kansas Histologic material was available from all of these cases, but only 130 with complete clinical and adequate follow-up records are used in this analysis

The general outline of Gall and Mallory's classification (Am J Path 18 381, 1942) is adhered to, with the substitution of Lymphatic Tumor Registry terms for some of their less familiar designations Most of the malignant lymphomas fall into 4 groups, namely, reticulocytoma, Hodgkin's disease, lymphoblastoma, and lymphocytoma

Compared with other types of cancer, malignant lymphoma is not common The present series represented slightly less than 5 per cent of all cancers examined during a twenty one year period The average age at onset—*i e* appearance of the first relevant symptom—was 44 7 years In general the disease is rare before twenty and after seventy years

In this material, which included complete autopsy studies on 30 cases, an extra nodal primary focus was found in only one third of the patients In 26 cases of the 130 it was reasonably assumed that the primary focus arose in one of the cranial structures, the tonsils and nasopharynx being the most common sites The gastro intestinal tract furnished the primary site in 19 cases It is believed that in a majority of instances the disease begins and runs its early course in the lymph nodes alone

Cervical nodes represented the primary site of lymph node involvement in 40 per cent of the series, axillary nodes in 9 per cent, inguinal nodes in 13 per cent, abdominal nodes in 4 per cent Mediastinal nodes were enlarged in 8 per cent and the disease appeared to involve almost the entire node system simultaneously in less than 2 per cent Numerous organs were involved secondarily including the liver, spleen, lungs pleura skin and bones The average duration of life from onset was only 26 7 months

replaced muscle tissue in certain areas The picture was that of a congenital metanephric cyst, without evidence of malignancy

The authors believe that the findings in their case are to be explained by non-union of the metanephric mass and ureteric bud to form the right kidney As a result the metanephric mass remained in its fetal position and proceeded to normal development with the formation of a cyst as the result of accumulating secretion Absence of the kidney on the right led to a compensatory hypertropy on the left JOSEPH P TOMSULA, M D

Significance of Retrograde Pyelography in the Diagnosis of Paranephritic Abscess Hubert Mäder Schweiz med Wchnschr 77 560–564, May 24, 1947

The clinical and laboratory findings in paranephritic abscess are often such as to leave the diagnosis doubtful Plain films of the abdomen, if there is good clearing of the gas shadows, may show a diffuse haziness of one kidney region, irregular broadening of one kidney shadow with poor definition, disappearance of one psoas shadow, elevation or immobility of the diaphragm on the affected side, a secondary pleurisy, or scoliosis toward the affected side, but since these signs occur in other surgical conditions they do not of themselves lead to a diagnosis Urographic study gives additional information With the intravenous method, the kidney shadow on the diseased side is denser and larger, the ureter is shown clearly throughout its length, and the kidney is displaced by the mass of the abscess Retrograde pyelography shows displacement of the kidney, rotation and imbalance of the entire pelvic system on all axes, compression of the pelvis, filling defects, and deformity of the calices All of these findings arise from external pressure Study of the respiratory excursion of the kidney is of no conclusive significance Tumors may give rise to a similar picture, but the general clinical findings will distinguish these A lateral pyelogram is of great value, in 90 per cent of cases there is forward displacement of the kidney, so that it lies in front of the vertebral bodies

LEWIS G JACOBS, M D

Translumbar Aortography, an Aid in the Management of the Hydronephrotic Kidney A Keller Doss South M J 40 376–381, May 1947

A discussion is presented of translumbar aortography in the study of renal surgical problems Anatomically the value of the information obtained by outlining the renal arterial tree is obvious, particularly in the diagnosis of embryologic abnormalities From the point of view of physiology and pathology, the usefulness of the procedure, though less striking, is becoming more apparent as clinical and pathological studies demonstrate the association of certain abnormalities of the renal arterial pattern with various syndromes and specific entities

The author has devoted himself chiefly to the use of aortography as an aid in the management of hydronephrosis It is his practice to obtain an arteriogram before undertaking renal exploration, and the knowledge thus obtained has often proved the deciding factor in answering the question Should an effort to save the kidney be made or should it be removed? Accepting the policy that a kidney is no better than its arterial supply, he makes every effort to preserve hydronephrotic kidneys in which this is adequate, reserving nephrectomy for those in which the circulation is poor It is his belief that surgeons should be more conservative in the treatment of hydronephrotic kidneys, especially in the young

Eight cases are briefly presented, with reproduction of arteriograms and retrograde pyelograms In a number of instances the two were obtained in combination The renal arterial circulation is clearly demonstrated

WILLIS MANGES, M D

Roentgenological Localization of Ureteral Obstruction by Non Radio-Opaque or Indistinguishable Calculi G Gill and W Light Canad M A J 56 513–519, May 1947

The authors describe a method of localizing exactly the offending agent causing ureteral obstruction, be it opaque or non-opaque Intravenous urography is used to demonstrate the site of obstruction Following the administration of 20 c c of dye, films are taken at five minute intervals for the first fifteen minutes (abdominal compression must not be used, since the method is essentially functional) These afford the authors' first roentgen sign, namely *early radiologic evidence of ureteral block* The first few films show a clear-cut outline of the collecting system on one side and lack of visualization of the collecting system on the other side *i e*, one kidney excretes the dye promptly and the other not at all

On subsequent films obtained at intervals of fifteen minutes, the shadow of the kidney on the involved side *which was not at first clearly distinguishable, becomes* visible, appearing denser and denser with time, until it stands out more prominently than the normal kidney on the opposite side This *impregnation of the renal parenchyma* constitutes the second radiological sign

Now that the parenchyma is densely impregnated with dye, the minor and major calices begin to show up and in subsequent films made at intervals of fifteen or thirty minutes, the renal pelvis is seen filled with dye and the ureter is demonstrable The dye comes slowly down the ureter until it is sharply halted, indicating beyond question the site of obstruction This third sign is called by the authors *the stasis*

By the time the obstruction is localized, it is noted that the dye outlining the collecting system on the normal side has come and gone The radiograph now obtained is a mirror image of the visualization of the collecting system at the beginning of the examination This confirmatory sign has been called a *reverse visualization of the collecting system*

In 51 cases in which this procedure was used, it led to the localization not only of 25 easily distinguishable stones, but also of 20 which were otherwise indistinguishable from a maze of calcifications and phleboliths, and of 6 that were definitely not radiopaque *Five case histories* are included, and films are reproduced DANIEL WILNER M D

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of artificial radioactive isotopes as substitutes for radium, and the health hazards involved in the use of artificial radioactive isotopes

Radio-Autographic Studies of the Distribution of Lewisite and Mustard Gas in Skin and Eye Tissues Dorothy J Axelrod and Joseph G Hamilton Am J Path 23 389–411 May 1947

The distribution of two war gases, mustard and lewisite, labeled with radioactive sulfur (S^{35}) and radio active arsenic (As^{74}), respectively, in skin and eye tissues has been studied by the radioautographic technic In all of the autographs, mustard gas penetrated the skin much more deeply than lewisite with a corresponding exposure This deep penetration could explain the great destruction and deep burns resultant from exposure to mustard gas In both the mustard and lewisite studies an accumulation of these two materials was noted in and around blood vessels With destruction of blood vessels and subsequent local anemia, one would expect slow healing of the affected skin area to ensue, which is a characteristic feature of these burns

In rabbit eyes exposed to mustard gas this material was fixed primarily in the cornea, with a small amount in the conjunctiva, and a very small amount in the iris and lens

The authors' method of making the radioautographic studies is described By this method it is possible to determine the radioactivity present in small regions of tissue sections, *i e*, in blood vessels hairs, hair follicles, and accessory glands of the skin

EFFECTS OF RADIATION

Induction of Ovarian Tumors in Mice by X-Rays J Furth and M C Boon Cancer Research 7 241–245 April 1947

Following irradiation of four- to six-week-old mice with 87 r, 175 r or 350 r ovarian tumors began to appear when the mice were about eleven months of age The frequency of these neoplasms increased with time and in almost every mouse that lived seventeen months a unilateral or bilateral ovarian growth developed, irrespective of the dose of irradiation

All mice were F1 hybrids of Rf females and Ak males and were thus genetically alike This stock was used because it has a low incidence of neoplastic diseases, because it appears relatively resistant to the usual intercurrent infections, and because of its longevity The factors of irradiation were as follows 140 kv, 5 ma 30 cm target-skin distance, with an inherent filtration of 1 mm aluminum The mice were "painted" twice a week with methylcholanthrene.

The ovarian growths are compared as to pathogenesis and autonomous character with the hyperplastic nodules that result from implantation of normal ovaries into the spleens of castrated mice It is concluded that the latter are not autonomous neoplastic growths (although they sometimes give rise to true neoplasms), while the x ray-induced ovarian growths, on the contrary, are readily transplantable autonomous growths

The factors necessary for the induction of ovarian growths in mice and the bearing of the observations made on the general problems of carcinogenesis are discussed

On the Mechanism of Shock or General Reaction of Cells and Organisms to Injury (Outline of a Working Hypothesis) Jørgen E Thygesen Acta radiol 28 1–13 Feb 28 1947

According to the working hypothesis outlined by the author the general as well as the local defense of the organism is closely associated with the amine metabolism and vegetative nerve processes No matter whether a local injury to the tissues is produced by morbid processes or by intentional measures *e g* roentgen irradiation, a general effect will appear threatening the existence of the organism This reaction is connected, among other things with the processes of regeneration by which the organism tries to counteract the local necrobiosis

The central point in the mechanism of injury to the cell is the change in its protein structure, which governs its chemical exchanges The function of the adrenal cortex plays a determining role in the defensive capacity of the organism, as desoxycorticosterone (adreno cortical hormone) stimulates the synthesis of protein by the cells and thus tends to normalize the injured protein structure Acute states of shock are associated with cortin deficiency or relative adrenocortical insufficiency on account of the incapacity of the organ for immediate adjustment to the increased requirement Roentgen intoxication represents a protracted state of shock which according to theory and the experiments of the author, is amenable to treatment with desoxycorticosterone or histamine

Radioactive Emanations Their Nature, Mechanism of Action, Biological Effects and Tolerance Limits Bradford N Craver J Indust Hyg & Toxicol 29 196–200, May 1947

The characteristics of the various common types of radiation produced by atomic disruption are reviewed The nature of the biological changes that they produce is discussed as well as the mechanism of their production The curie and the roentgen are defined and human tolerance limits stated in terms of those units

Provisional Calculation of the Tolerance Flux of Fast Neutrons. J S Mitchell Brit J Radiol 20 177–180 May 1947

Calculations of the theoretical flux of fast neutrons equivalent to the 0 1 r per day tolerance dose were made by applying Placzek's theory of the slowing down of fast neutrons by elastic collisions with atomic nuclei (Phys Rev 69 423 1946) These calculations suggest that the flux of fast neutrons corresponding in biological effect to a dose of 0 1 r of the usual filtered gamma radiation from radium of approximate mean energy 0 8 Mev delivered in eight hours has the approximate constant value of 85 neutrons per square centimeter per second for neutrons of energy 2–20 Mev Because of the lack of experimental evidence of the biological effects of neutrons, it is probably safer however to use 20 neutrons per sq cm per second as the tolerance dose This value can be doubled for neutrons of energy 0 5 Mev SYDNEY J HAVILL M D